Tibetan Books And Scrolls And Their Conservation

H. E. Roswitha Ketzer

M.A. Conservation

Camberwell College of Arts
Department of Art History and Conservation
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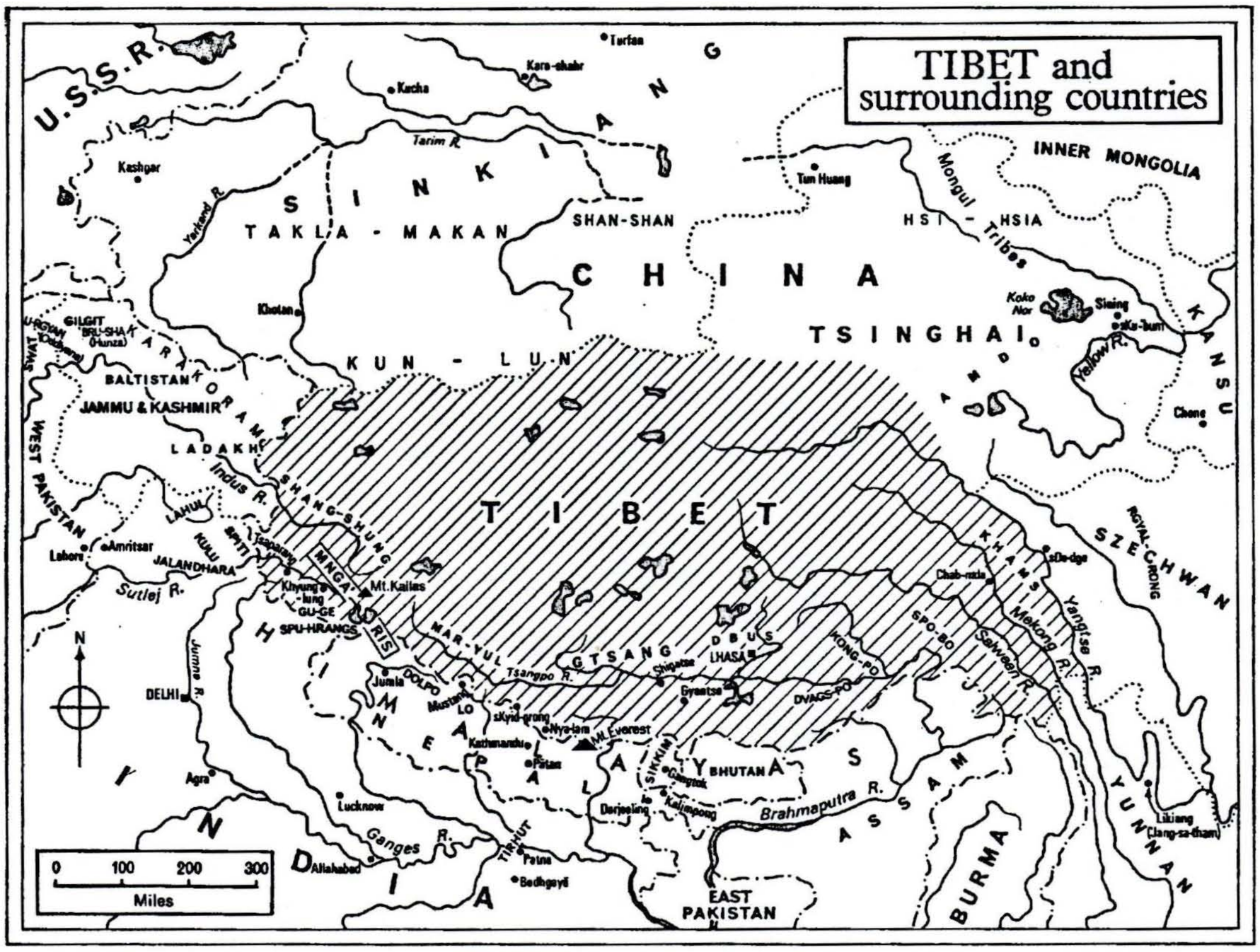
Introduction

This thesis dicusses the conservation of Tibetan manuscripts, books and scrolls. The aim is to compile a thorough background knowledge of traditional Tibetan book and paper production prior to conserving the objects, by assembling available information and analysing Tibetan paper samples. Typical conservation problems of Tibetan manuscripts and books have to be identified and appropriate treatments to be found.

The scope of this research is the historical and cultural background of the people of Tibet, to understand the evolution of the printed word and type of support and which materials were used and how. Different book formats, scripts and decorations are compared in relation to the different texts, as well as manuscripts and prints which are not found in book form but as scrolls in prayer-wheels, charms and sculptures. Traditional storage methods and protective materials will be discussed and ethical considerations will be taken into account before conserving the objects. There is also the question of the authenticity of four prayer scrolls.

Analysis of papers and pigments will be carried out following literature surveys to establish a list of typical constituents. This will lead to the information needed to decide which materials are appropriate for use in the conservation treatment of Tibetan books and manuscripts.

Tibetan books, manuscripts and scrolls are to be found in many major European, North American and Asian collections. Most of these documents are not dated. The desire to preserve Tibetan heritage is rising since the Chinese invasion of Tibet in 1950 and the forceful destruction of Tibetan culture.



Taken from Snellgrove and Richardson, *A cultural history of Tibet*, p. 282

1. Tibet

1.1. Country and people

There is no general agreement about territorial limits of Tibet. In this thesis I distinguish between "political" Tibet (nowadays the Chinese autonomous province of Xizang) and traditional or ethnographic Tibet, as refered to by H. Richardson[1]. Names and spelling of places in Tibet vary according to different sources, I use the modern Chinese pin yin transliterations.

Tibet is often referred to as "the roof of the world." Lhasa is its capital city. Political Tibet occupies aproximately 1,250,000 km^2 of the plateaus and mountains of Central Asia, including the world's highest peak, Mt. Everest. In the north are the Kuen Lun and Tang La ranges, to the west the massif of the Karakoram and to the south the Himalayas. Political Tibet is bordered by the Chinese provinces of Sechuan to the east, Yunnan to the south-east, Qinghai to the north-east, the Chinese autonomous province of Xinjiang to the north-west, the state of Jammu and Kashmir to the west, with India, Nepal, Bhutan, and Burma to the south. The greater part of Tibet - perhaps three-quaters - is a high, tangled wilderness of mountain ranges and plains, all of which are at least 5,000 metres above sea level and uninhabited or sparsely scattered with nomads. In this area lie the sources of some of the greatest rivers of Asia, in the south-west the Indus, Brahmaputra, Sutlej and Karnali, in the east the Trisuli, Arun, Manas and Subansiri and in the north-east the Yangtse, Mekong, and Salween. The southern quarter of the country contains the valleys of some of these great rivers and their tributories where, from an elevation of some 4,500 metres down to 1,800 metres, lies the main cultivated area of Tibet.

Ethnographic Tibet includes traditionally three regions, the Central region (Ütsang), the Eastern region (Kham) and the North-eastern region (Amdo). Besides Lhasa, the capital city, with a population prior to the Chinese occupation of some 50,000 people, Shigatse,

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[1] H.E. Richardson, p.2.

Gyantse and Chamdo are the next largest and had population of 8,000 to 12,000[2]. The total number of population in Tibet varies widely according to different sources. There are estimates from 900,000 to 3,000,000 before annexation by China in 1951. The size of population remained constant until then, due to the custom of polyandry, by which several brothers share one wife, and the neutralization of a large part of the male population who join the celibate monasteries. The community of monks was numbered as one monk for every three of the entire lay community, including women and children[3].

Although Tibetans refer to their country as "Land of the Snows", the climate is generally dry, and most of Tibet receives only 0,43 m of rain and snow annually. The Himalayas act as a barrier to the monsoon from the south, and precipitation decreases from south-east to north-west. The perpetual snow line lies at about 5,000 m in the Himalayas but rises to about 6,000 m in the northern mountains. Humidity is low, and fog is practically nonexistent. Temperature in the higher altitudes are cold, but in the lower valleys of the south-east can be mild and pleasant. The temperature differences occuring during a 24-hour period are greater than the seasonal variation due to intensive sun radiation. Lhasa, which lies at an elevation of 3,600 m, has a maximum average temperature in June of 17°C and a minimum average temperature in January of -14°C. The cold temperatures of the early morning and night are aggravated by the gale-force winds that blow throughout most of the year. Because of the cool dry air, grain can be safely stored for 50 to 60 years, dried raw meat and butter can be preserved for over a year, and epidemics are rare.[4]

Of the racial origins of the Tibetans little is known[5]. The majority of Tibetans have the same ethnic origin, traditionally practiced the same religion, and speak the same language. The population is however, divided into social and economic strata. The basic economic groups were the nomads, semi-nomades, agriculturalists, and forest

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[2] id. p. 7.
[3] Encyclopædia of Religion and Ethics, p. 789.
[4] Encyclopædia Britannica, p. 374.
[5] H.E. Richardson, p. 5.

dwellers. There were also traders, craftsmen, government officials, monks and nuns. These groups did not constitute rigid casts, monks, for example, could be government officials, and nomads or agriculturalists could be traders. Social divisions existed between the nobility and the peasantry. There were more than 175 noble families in Tibet. The overwhelming majority of the population were members of the peasantry.

Tibet had a theocratic government of which the Dalai Lama was the supreme religious and temporal head. He was chosen for life, in accordance with religious traditions and ceremonies, as a reincarnation of his predecessor.

There were a few secular schools in Tibet before the Chinese occupation. The monasteries were the main seats of learning, and some of the larger ones were similar in operation to theological universities.

Before the 1950s Tibet was a unique entity, that in its isolation from the rest of the world, made little effort to facilitate communication with other countries, and economic development in Western terms was minimal. No wheeled vehicles were used, transport was by riding and pack animal. There were no roads, but rough, narrow tracks, and no bridges over major rivers.

The economy of Tibet operated under a free enterprise system dependent upon supply and demand. Currency was allowed to float on the market for foreign exchange purposes. Government tax revenues were mainly paid in the form of goods. Agriculturalists and nomads paid with services or in kind, and businessmen paid with the goods they handled. Taxes were collected by district administrators and by travelling tax collectors[6].

The Tibetan lunar year theoretically consists of twelve months of thirty days each making a total of 360 days. To keep the lunar calendar in agreement with the actual lunar and solar years, and to avoid unlucky days, unpredictable adjustments are made. The new year begins with the rise of the new moon in the Western month of February, except following the year when the intercalendary month

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[6] Encyclopædia Britannica, p. 376.

was added, then it begins in March. A new Tibetan calendar is prepared towards the end of each year by the official astrologer, who determines which unlucky days are to be omitted and which days are to be duplicated. It is impossible to set up a formula for the conversion of Tibetan days and months into their Western equivalents unless one possesses the actual calendar for the year in question.[7] The School of African and Oriental Studies, London owns a computer system, which can convert the Tibetan year into the Western year.[8]

1.2. Religion

Buddhism is the dominant religion, which was introduced into Tibet from India between the 7th and 9th centuries A.D. Folk religion and a more specialised form of it called Bon is claimed as the earlier or original religion of Tibet. All three religions are still present, and have intermingled with each other. Writers on Tibetan religion refer in the plural to the religions of Tibet, meaning the folk religion, called the "Religion of Men", Bon and Buddhism, the two latter organised into systems by the monastery, ritual and scripture. The Buddhism which is praticed in Tibet is often called Lamaism - though not by Tibetans - after the name they give to a Buddhist teacher "lama".

The folk religion divides the world into three: heaven, atmosphere and earth, and peoples it accordingly with upper, middle and lower gods. The latter comprise water deities, often thought of as snakes, spirits of rocks and trees and earth gods who must be propitiated when the soil is tilled. Like the middle spirits of the air, thought of as red, savage and armoured huntsmen, they all, when offended, cause sickness and death. There are many legends connected with the mountain gods who belong to the middle region or atmosphere. There was also an ancient god of heaven surrounded by attendants, some of whom have, among the Buddhists, become demons. Other spirits included a field god, a tent god, a house god and a hearth god.

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[7] T.W.D. Shakabpa, pp. 15-17.

[8] According to Mr. Gyurmi Dorje, School of African and Oriental Studies, London.

Bon was a form of shamanism, which depended for its authority on the fear it could instill in the minds of its followers, and on the display of magical power designed to allay that fear. During the early introduction of Buddhism into Tibet it served as a focus for feudal opposition to the central monarchy which patronised Buddhism. Buddhism was traditionally founded around 520 B.C. by one Siddhartha of the Gautama clan, known as Buddha or "enlighted one". For some forty years the Buddha wandered through parts of eastern India preaching his doctrine, ordaining monks and prescribing their disciplinary code and organisation. Buddhism has remained a monastic religion, nowhere more so than in Tibet, and monasteries have played a vital part in teaching and developing religious beliefs and their philosophical basis. The belief is in incarnation or the passage from life to life via the moral effect of actions: as a man sowed in one so he reaped in another. This proposition was linked in Buddhism with the concept that suffering was inseparable from life. Good actions led to good rebirths but their effect was temporary. Pain and sorrow were earned in retribution and would return when the good effects of previous actions had expired. Salvation could come only from the knowledge and practice summarised in the Four Noble Truths: the truth of suffering, for instance pain, loss and death; the truth of the cause of suffering, namely the ignorance that leads to desire for life and its false and temporary gratifications, for these are the motive-power of its renewal in sorrow; the truth of the cessation of suffering, the possibility of salvation from the series of rebirths through the destruction of ignorance and desire; and the truth of the means, the Noble Eightfold Path, a set of moral and meditational practices by which false views and retribution-earning acts were eliminated. The successful following of the Eightfold Path led to "nirvana", salvation form all worldly suffering. A person who achieved this was an "arhat" and his physical death was his last. This became the early Buddhist ideal.

1.3. Culture

In Tibetan culture the influence is sometimes to be seen as predominantly Chinese, sometimes Indian, but nearly always there is a blend of one with the other which makes them neither wholly Chinese nor Indian, but Tibetan. The Indian style would no doubt have been from Bihar and Bengal and was closely related to the Nepalese which, though already present earlier, would increasingly have replaced the eastern Indian source after 1200. Nepalese inspiration was at that time and later, of capital importance. Kashmiri and related styles were established in the western Himalayas owing to the important part played by the kingdom of Gu-ge in the revival of Buddhism in the tenth century and its dependence on Kashmiri Buddhists. Chinese influence, though subject to fluctuation, has never ceased to make itself felt in the arts and crafts since the time of the Yuan dynasty (1279 - 1368), when Tibetan Buddhists acquired a powerful influence over the Mongol Emperor of China, Kublai Khan (1260 - 1294).

Tibetan conservatism is reflected in all aspects of their culture. Although a high degree of skill and craftsmanship is attained in painting, wood-carving, and metal work, the products are on traditional lines, almost entirely of a religious nature, and conscious invention is not much in evidence. In architecture too, although the technique is skilful and the design often impressive, there is little development. Similarly in literature, the scope is restricted to religious works and, while much ingenuity and thought are devoted to elaborating and expounding the philosophical ideas of the doctrine, there is little opportunity for the secular imagination.

Tibet is most renowned for its religious scroll paintings (thang-ka), metal images, and wooden block prints. There are three categories of images representing the peaceful, moderate and angry deities, and three schools of painting, the Sman-thang, Gong-dkar Mkhan-bris, and Kar-ma sgar-bris, which are differentiated by colour tones and depicted facial expressions.

For the Tibetans themselves art has a purely religious function. All art is sacred, even the most everyday objects such as spoons, teapots, tables and carpets are decorated with Buddhist motivs in order to remind the user of their faith. The Buddhist practitioner uses thang-kas and sculptures as visual aids for meditation. The visualization is extremly important in a specific meditation technique called Vajrayana.

Both Buddhist iconography and iconometry have to follow strict canonical laws as laid down in the texts. Thus the composition, proportions, shapes and colours of sacred images are never determined by the individual choice of the artist, but are govermed by these religious, philosophical and ritual rules. Iconometry refers to the mathematical proportions which have to be adhered to, and if incorrect the image is regarded as spiritually useless. The measurements used normally relate to a part of the body, for instance the length of the patron's forearm or the artist's finger. These rigid laws allow the artist little scope for freedom. In conjunction with the appropriate text, most artists use pattern books, pounced drawings or woodblock prints for the initial inspiration. To create a work of art is an act of devotion and prior to its creation, the artist has to be prepared through specific rituals.

After the image is created, it has to be consecrated before it can be used for meditation, worship or inspiration. The blessing and "empowering" of religious objects is a Buddhist tradition of long standing. During the consecration ceremony the image is animated for religious use by a lama, who imagines and projects the spirit of the actual deity onto the work of art. Symbolic of this animation is the inscription of the mantric syllables "Om Ah Hum" on the back of paintings. Sometimes the lama would further consecrate the painting by putting his hand or footprint on it. In the case of statues, the hollow body is filled with sacred relics, mantras and texts and then sealed with a plate.

Tibetan art is essentially anonymous, as to sign a work of art would be considered egotistical and thus contrary to Buddhist practice[9].

1.4. Political situation

In 1949 the "liberation" of Tibet from feudal rule was heralded by the Chinese Communists. In October 1950, troops of the Chinese army invaded and occupied Tibet, an independent country the size of western Europe. The poorly equipped Tibetan troops were overwhelmed. An appeal by the Dalai Lama to the United Nations was denied, and expected support from India and Britain was not forthcoming. A Tibetan delegation summoned to China in 1951 had to sign a treaty dictated by the conquerors. It professed to guarantee Tibetan autonomy and religion but also allowed the establishment at Lhasa of Chinese civil and military headquarters. Pressure was exerted to bring Tibetan society and government into line with those of Communist China. The unique authority of the Dalai Lama was undermined by dividing Tibet into three regions.

The Tibetans were offered some modern benefits, such as hospitals, new agricultural methods, schools (under Chinese supervision), and rudimentary local industry. But the greater progress was in making roads and bridges, an innovation for the Tibetans, who had no wheeled vehicles, and a necessity for the extension of armed Chinese control.

Smoldering resentment at the strain on the country's resources from the influx of Chinese soldiery and civilians was inflamed in 1956 by reports of savage fighting and oppression in districts of Kham. Refugees from the fighting in the east carried guerrilla warfare against the Chinese into central Tibet, creating tensions that exploded in a popular rising at Lhasa in March 1959. The Dalai Lama, most of his ministers and many followers escaped across the Himalayas and after days of fighting and bloodshed the rising was fiercely suppressed.

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[9] Z. Fleming, pp. 11-12.

The Tibetan government was replaced by a military dictatorship intent on imposing the pattern of China. It immediately demolished the framework of Tibetan society and the influence of church and nobility by confiscating all private property. The country was reorganized into peasant associations in preparation for collectivization and communes. The new Panchem Lama, traditionally more closly linked to the Chinese, was appointed chairman of an interim administration. The practise of religion was supressed, countless Buddhist temples were abandoned, and the monks either fled, were imprisoned, or reverted to lay life. Strict regimentation, monopoly of agricultural production, prevention of travel by Tibetans, severe punishments, and forced labour for suspected opponents were aggravated in 1961 and 1962 by near famine resulting from the upheaval. More refugees fled to India, guerrilla activities continued, and the Panchem Lama, rapidly disillusioned, was dismissed and disgraced in 1964. Between 1963 and 1971 no foreign visitor were allowed to enter Tibet, and only a few Nepalese traders remained.

Since 1979, the "mistakes" of the Cultural Revolution have been appologised for and "corrected", according to Chinese authorities. But in the wake of the economic reforms since 1980, the Tibetans face a different threat, mass immigration by Chinses settlers. The wave of resettlement became apparent 1983, partly as a result of what seems to be government policy, and partly due to economic changes. There were opportunities for profit following up the opening of Tibet for the tourist trade. Exiled Tibetans are concerned that this process could lead to Tibetans becoming a minority in their own land, which would once and for all disenfranchise them from the future political process, as well as threatening their culture with extinction.

Detailed accounts show that arbitrary arrest, torture and detention of Tibetans for political offences is still rife. More than a million Tibetans died as a direct result of Chinese rule, through murder, starvation and torture. Six thousand of Tibet's ancient moansteries and temples have been destroyed. The Buddhist religion

cannot be freely practised. Every day, individual Tibetans put their lives in danger by protesting against Chinses rule. Demonstrations by monks, nuns and other Tibetans are brutally crushed by the Chinese. Many Tibetans live in constant fear of arbitrary arrest and interrogation.[10]

100,000 Tibetan followed the Dalai Lama into exile in 1959. Thousands more still try to escape across the borders into Nepal and India. Large parties of children are sent across the mountains into India by their parents in the hope that they will have a better life away from Tibet. The Chinese government sent thousands of Tibetan children to central China for their entire secondary education; many of these children return to Tibet after seven years away, speaking only Chinese.[11]

The old culture and religion of Tibet is now openly preserved only by some 120,000 Tibetan refugees living in settlements in India, Nepal, Bhutan, and Sikkim.

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[10] Tibet Support Group. UK, pp. 3-5.
[11] ibid.

2. Historical bibliography of Tibet

The manuscripts and printed books in Tibet are of various types, Sanskrit originals, translations from Sanskrit into Tibetan, original Tibetan works, and a few Chinese translations of Sanskrit and Tibetan translations of Chinese. There are of course, secular works as well as religious, histories, medical treatises, poetry, goverment orders, military rules, deeds of gift and property. But these are not likely to be found in monastic libraries, which are naturally devoted to religious works. The Buddhist canon, the two great Tibetan collections, the "Kanjur" (bKa'-'gyur, literally "Translation of the Buddha-Word") and the "Tanjur" (bsTan-'gyur, literally "Translation of the Treatises") are the chief works to be encountered. The Kanjur purports to be all the spoken words of Lord Buddha, and these are gathered together in one hundred and three volumes. The Tanjur includes all the availabe translations of commentaries, exegetical literature and discourses by Indian Buddhist scholars and yogins and are generally comprised in two hundred and thirty-five volumes. The number of volumes varies according to different sources.

Contemporary sources for the early period (600-900 AD) consist of fragmentary annals, chronicles, and administrative documents, mostly from the cave library at Dun-huang. There is little until the flowering of Buddhism in the 13th century, when monk-scholars began to compose religious histories and royal genealogies.

Today, the rich monastery libraries of Tibet have been lost, new material is sometimes found in the possession of refugees or in little-known monasteries in Nepal, Bhutan, Ladakh, and from Mongolia.

A list of major collections of Tibetan manuscripts and books in several countries other then Tibet or China is located in Appendix I.

An interesting source of information is the book by Peter Hopkirk "Foreign devils on the Silk Road"[12], who sheds light on the way Tibetan and Chinese manuscripts came into the possesion of foreign libraries. He also dicusses the question of what might have happened to the items if they had stayed in their country of origin, and what happened to them in the foreign country.

2.1. Evolution of printed word and types of support

The introduction of writing and Buddhism which were both introduced from India, have a close link in Tibetan history. The transformation of Tibetan speech into a literarary languge changed Tibetan society into a mainly Buddhist one. But the development of the Tibetan script, the printing process and methods of paper making stopped, and remained at the same level at the time of introduction.

a. The first book

Knotted cords were originally used in Tibet as a means of comunication, but there is no information about their system of usage. The bare statement comes from the Chinese Annals of the T'ang dynasty[13].

The first mention of a book in Tibetan history was at the time of King Tho-tho-ri Nyantsen, who was born ca. A.D. 173. When he ascended the throne he became the twenty-eighth king according to the Buddhist tradition. It is said that when Tho-tho-ri Nyantsen was sixty years of age, in A.D. 233, he received a book of Buddhist scripture, while living in the palace of Yumbulagang. He could not read the book because it was in Sanskrit and there was no one in Tibet at that time who could translate that language. The king called the book Nyenpo Sangwa (The Secret) and a secret it remained for many years. Not wanting his ministers to know that the book had come from India, the king told them it had descended from the sky

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[12] Hopkirk, Peter. Foreign devils on the Silk Road. Oxford: Oxford University Press, 1980.
[13] T. De Lacouperie, p. 425.

and that he had been shown in a dream that, after four generations, there would be a king able to read and understand the book. An early Tibetan historian, Nel-pa Pandita, mentions that the book was received through a certain Pandita Losemtso of India.

Four generations later, in A.D. 617, Namri Songtsen, the thirty-second king, had a son named Tride Songtsen, who is better known today as Songtsen Gampo or Sron-btsan-sgam-po. Songtsen Gampo ascended the throne at the age of thirteen and ruled from 620 until 649. In time, he drew up ten moral principles and sixteen rules of public conduct for his people. A few years later, he sent his minister, Gar Tongtsen with gifts and a letter to the Nepalese King, Amshuvarman, to ask for the hand of the Princess Bhrikuti Devi in marriage. This is the first ever mentioned Tibetan letter. It is not known which form of writing was used. Amshuvarman sent his daughter to Songtsen Gampo and she took with her an image of the Aksobhya Buddha. This was one of the first Buddhist images to be found in Tibet.

The exact date is not known, when King Songtse Gampo sent his Minister Thon-mi Sam-bhota (also known as Brin-to-re) with sixteen companions to India to learn the Sanskrit language. Thon-mi Sam-bhota went to Kashmir in northwest India, where he had as his tutors Lipi Kara and Devavidyasimha. The Tibetan students who accompanied him to India died there. After Thon-mi Sam-bhota returned to Tibet, around 632, he used his knowledge to devise a Tibetan script. He then is said to have translated the book, The Secret, preserved since the time of Tho-tho-ri Nyentsen, and so its contents were made known to the people. The book was considered of equal importance to the Tibetan people as the first introduction of the Buddhist religion into Tibet, and is reflected in the fact that modern currency notes are dated in so many years from the arrival of The Secret, which is said to have been in A.D. 233.

The first Tibetan dictonary was compiled during the time of King Ralpachen, who took rule in 815. During his reign he invited three Indian pandits, Silendrabodhi, Danasila, and Jinamitra, to central Tibet and provided them with two prominent translators, Kawa Paltsek

and Chogro Lui Gyaltsen. The names of these translaters appear at the end of almost all Tibetan books of the period, as they were responsible for the revision of the Buddhist texts, which had been translated earlier. They standarized the terms used for translation of Buddhist concepts from Sanskrit. The first dictionary was compiled and called the Mahavyupatti. It was a Sanskrit-Tibetan lexicon and indispensable for those translating Buddhist texts[14].

There are different opinions about which model of script was used to form the Tibetan script. A.F.R. Hoernle favours the Khotan script as origin, J.Ph. Vogel talks about the Gupta script, J. Filliozat sees a resemblance with the writing on the bricks from Gopalpur in Gwalior, and Günter Grönbold takes the Proto-Saradna scripts into considerations. It is certain that the Tibetan script is derived from an Indian script, and Thon-mi Sam-bhota invented six additional signs for representing certain sounds existing in Tibetan and not in Indian languages. He invented two general types of script, which are the literary character, called dbu-chan, that is, "headposessing", and the cursive script, used for every-day purposes, called dbu-med, that is, "headless". The main difference between dbu-chan and dbu-med consists, as the names indicate, in the characteristic top-line being a part of the dbu-chan signs and absent in those of the dbu-med.

The script, which was invented by Thon-mi Sam-bhota has not changed until today, which makes it difficult to date writings with the help of palaeography. There is no doubt, that the spelling of the Tibetan script originally represented the actual pronounciation, but the current spoken language of Tibet has undergone extensive changes, including the introduction of some new sounds and the loss of some consonants, so that now the writing is very far from being a true representation of speech[15].

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[14] T.W.D. Shakabpa, p. 49
[15] D. Diringer, p. 352 -357

b. Forms of Writing and Printing Support

The traditional forms of support which are known today are either birchbark or paper, as well as stone, textile and metal. Paper was used in the form of books, charms, scrolls and for drawings.

Birchbark was only used for special occasions like short texts, e.g. dharamis, mantras and rarely sutras, until approx. the 17th century. Birchbark derived from the birch, which is a moderated sized, deciduous tree growing to a height of about 4,600 metres in the Himalayas. It was the inner bark of the tree which was used for writing. The bark, after being peeled off the tree, was dried. Oil was then applied over it and it was polished. Finally the birchbark was cut to a suitable size.

When papermaking was introduced into Tibet is not clearly stated. There are also different opinions if the process was introduced from China or via Thailand[16]. In making paper in Tibet the inner bark is peeled from the stalk of the shrub and then the material is boiled for two days[17]. Trier[18] and Grönbold[19] mention, that the inner bark of the shrub is boiled in lye of ashes for two hours and that the ash particles are removed by rinsing. Then the pulp is beaten to a fibre by hand with a heavy mallet. The macerated fibre is then mixed with water and thoroughly agitated. The stock, or watery pulp, is then poured upon the mould, rather than dipping the mould into the fibrous water. For this particular method of forming sheets of paper the mould is floated on a stream or pool of clear water, and is covered with a cloth as it floats on the surface of the stream. The moulds used in Tibet are constructed so that the paper is long and narrow in shape, conforming to the character of Tibetan books. The cloth upon which the paper is actually formed is pure cotton woven by hand. Each sheet of paper must dry upon the mould, and therefore if much paper is to be formed, a good many moulds are required, as

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[16] W. Sandermann. Die Kulturgeschichte des Papiers. p.54.
[17] D. Hunter, p.111-114.
[18] J. Trier, p.95.
[19] G. Grönbold, p.356.

the process of drying a sheet of paper of a large size would require up to three quarters of an hour, even in the hot sun[20].
They still use the original method of making paper, using the "wove" type of mould in the formation of the sheets, which Ts'ai-lun invented in 105 A.D. in China.
For writing Tibetans use a pen made from a carved piece of bamboo. It is split in the front, has a bevelled edge at the back and its handle is round. They are manufactured by impregnating them with grease and then hanging into smoke, which makes them resistant. The pens are regarded as valuable, because bamboo has to be imported from another country[21].

c. Printing Presses

Wood-blocks, a Chinese invention, were used for printing the text of the sacred books and also the vast numbers of paper charms placed inside prayer-wheels and sculptures, flags bearing lucky devices and auspicious formulas attached to sticks or cord. The shape of these blocks varied according to their use. For books and many charms they retained the horizontal oblonge shape of the manuscript page which was derived from the format of the smaller palm-leaf strip on which Indian and Nepalese texts were written from ancient times almost to the present day. The wood-blocks were always carved mirror-style. It is not known how long this form of printing has been used in Tibet. The earliest dated blockprint is a Chinese Buddhist text, the Diamond Sutra made in A.D. 868. This was found at Dunhuang on the western borders of China, which, with other parts of Central Asia, had at that time been under Tibetan rule. But the technique is certainly a Chinese invention and there is no evidence of its use in Tibet at so early a date. Blockprinting in Tibet may go back to the eleventh century, when the Chinese already had moveable type, which was never adopted in Tibet.

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[20] Hunter, Koretsky, Trier, Grönbold.
[21] G. Grönbold, p.365.

No.2 Printing Block. Horniman Museum No. HM 464

In the preparation of a wood-block a piece of suitable wood, either hazel, birch or walnut, was cut to the required shape. The page or sheet to be printed was copied or removed from an existing book and pasted, face downwards, onto the surface to be cut, thus transferring the ink of the original to the uncut block. The paper was then removed by scraping or rubbing, or left on the wood with some oil added to make the letters or outline stand out. The block

was carved with a suitable engraving tool so that the letters or figures stood out in relief. While this was done the wood was moistened to make the cutting easier. This task required considerable time and skill as the text blocks might be carved on both faces. Once the block had been cut it was repeatedly oiled to strengthen the wood and to make it easier for the removal of pages during printing.

Printing was done by groups of two or three monks, dividing the operations between them, putting the block on a bench, rubbing ink over it with a pad, cutting and laying the paper on the block, running a roller or brush over it.

At the great monasteries like sNar-thang, Derge, sKu-'bum in Amdo and Choni in Gansu, complete editions of the scriptures were obtainable and large rooms housed tens of thousands of blocks on numbered shelves, but almost every monastery had a printing shop which produced at least charms and flags. A book was usually ordered new, rather than bought from a previous owner. The purchaser often had to supply the ink and paper, and the monks were paid for the work.

2.2. Prayer-wheels

Prayer-wheels consist of cylinders containing tightly rolled texts or repeated invocations, usually blockprinted[22], which when revolved from right to left the texts, if visible, could be read. Some prayer-wheels also have short invocations on the outside. Prayer-wheels range from huge barrels for which heights of nine to twelve metres and diameters of four and a half to six metres have been quoted, to the common and hand-held cylinder turned on a stick. Smaller prayer-barrels are found along monastery walls, inside the porticoes of temples, in the open where they are turned by the wind and water or in miniature indoor shrines, turned by hand. The hand-held prayer-wheel, made most commonly of metal and used everywhere in the lamaist world, revolve on a pin stuck loosely into a handle,

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[22] W. Zwalf, p. 86

with a ring of shell or ivory between cylinder and handle. A heavy cube or ball, usually of metal, attached to the side of the cylinder by a chain or cord sets up a centrifgual momentum which turns the cylinder on its axis.

In Tibet the word, either spoken or written, is considered as forming one of the Three Supports[23] and is therefore sacred. Merely to read or write prayers or extracts from the scriptures (or to pay for them to be read or copied) are acts of spiritual advancement. Some liturgies involve the repetition of the same formula over and over again in order to achieve a desired end. By an extension of the same principle it is believed that spiritual benefit can accrue by rotating prayers written on rolls of paper. The commonest formula in prayer-wheel is said to be the six-syllable invocation to Avalokitesvara: Om mani-padme hum.

It is almost certain that prayer wheels are a Tibetan invention. In this form they are not found outside areas which have received their Buddhism from Tibet[24].

2.3. Book formats, scripts and decoration in relation to their different texts

a. Format

There are two types of book to be found in Tibet, single leaf books (also called pothi book) and ones which are bound. The books retained the horizontal oblong shape of the manuscript page which derived from the format of the smaller palm-leaf strip on which Indian and Nepalese texts were written.

The bound book is either folded and bound at the longer head side or the shorter left hand side. It is bound in undyed cloth, and has no boards or end papers. Every gathering has a cloth joint at the outer double page. The

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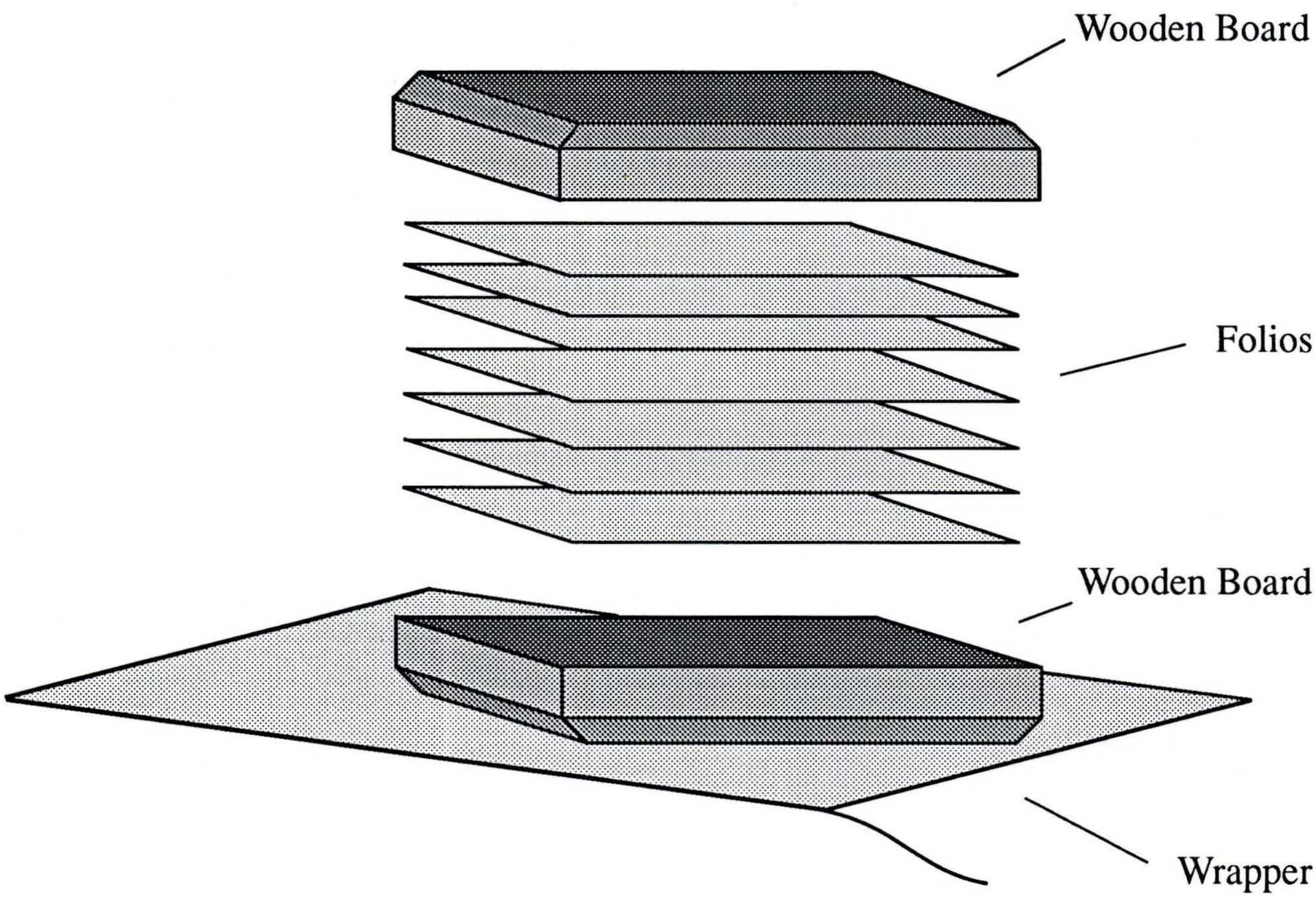
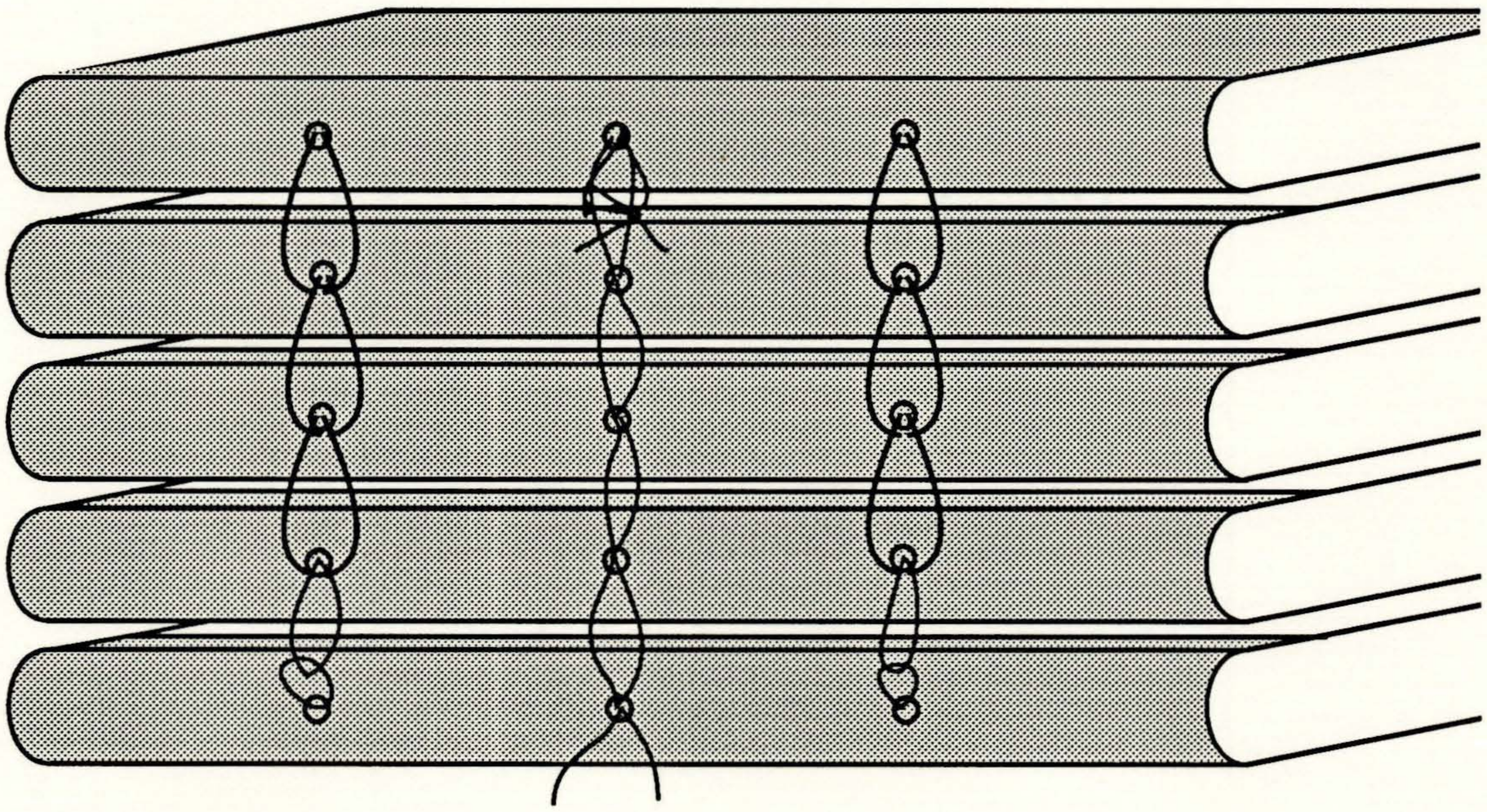
[23] Three Supports (the three elements which comprise the quintessence of every being): the stupa, or cast in bronze or brass, represent the spiritual plane; the book representing the verbal plane and, therefore, words; and the image or painting representing the physical plane. The presence of all three supports, an image or painting, a book and a stupa is important for many kinds of ritual.

[24] J. Lowry, pp. 75,79.

Pothi Book



Sewing structure of bound book.



book is sewn together with two threads in cattle stiches. There is a twisted thread attached to the sewing to hold the book together. This kind of books is usually a notebook or diary[25].
The pothi book is covered with wooden boards and wrapped in silk. The wrappers are mainly red, orange or yellow, but also blue and patterns are to be seen. According to Fred Marsh[26] these wrappers are called "basters", an Indian word.
The wooden boards have the same oblong shape as the Tibetan books but are slightly larger. Usually they are unproportionally thicker than the book itself and have bevelled edges on the top. The boards might be carved, painted, gilded or have inlays of precious stones.
These pothi books usually contain religious texts, commentaries, exegetical literature, discourses and anything concerning the life of a monk. In earlier times the only educational institutions in Tibet were monastries, therfore medical, astrological, astronomical and other scholarly texts are also to be found in this form.
The Buddhist monks usually recite prayers from their pothi books during ceremonies. After one page is read it is turned over and put down on the front board. This form of book is convenient for the monk as he has to handle ceremonial equipment during his recitations.
The book form chosen seems also to depend on its later storage condition. The pothi books were usually kept in monastries. The bound book was used by officials and travellers, who might have prefered this lighter weight book form and the way the paper was kept secure in its binding.

b. Script

There are several scripts in the Tibetan writing, and some of them have very specific usages. The most popular and main characters are the dbu-chan or headed letters and the dbu-med or the headless letters, from which the others derived.

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[25] According to Mr. Gyurmi Dorje, School of African and Oriental Studies, London.
[26] Head of the conservation department at the India Office, British Library.

The yi-ge dbu-chan, or, as the name means, the letters furnished with heads[27], were derived from the holy writing the lhai yi-ge or Landza. This writing is also called the "Divine writing". It is the main ecclesiastic script used for manuscripts and now commonly used in printing.

The second style of writing found by Tong-mi Samb'ota was called yi-ge zur-djan, i.e. letters furnished with an angle, or cornered letters, so called from the fact that the upper part or head of the letters were not as regular as the dbu-chan style.

The yi-ge zur-djan writing, properly the half-cursive, was developed into the more current dbu-med or head-less characters. The dbu-med (or umed) is the cursive script, used for every-day purposes and is the secular sript.

From the dbu-med a script called dpé-yig (from dpe "pattern, model") is derived. This is a more distinct and careful writing used for copying books.

Another kind of dbu-med is the 'k'yug-yig, which means "the running writing" or "current hand", and is an extremely abbreviated script. It is a cursive and often rather illegible style used in letter writing.

A third variation from the dbu-med is the 'bam-yig script. The very large and regular style was invented for use in elementay writing schools.

The most important variety from the dbu-chan is the seal-script. A famous Grand Lama of Sa-skya[28] played a great part in the conversion to Buddhism of the Mongolian imperial court, and adapted the Tibetan square script to the Chinese and Mongolian languages, replacing the Uighur alphabet. Under Chinese influence, this script, commonly called Passepa, was written in vertical columns downwards, although unlike Chinese, the columns read from left to right. This character, officially adopted in 1272, was only sparsely used owing to the convenience of the Uighur script and did not last long, but it

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[27] Also called rom-yig or "thick letters" in the Western provinces, and commonly called U-djan, dbu-chan or uchan.

[28] Bashbah or 'p'ags-pa "honourable" bLo-gros-rgyal-mthsan, in Chinese, P'a-k'o-si-pa, known as P'a-sse-p'a or 'Phags-pa, 1234 - 1279, invited to China by Kublai Khan.

lingered on at the imperial Chancery under the Yüan dynasty, particularly in the official seals.

A secret script, a kind of cypher, is used for official correspondence called rin-spuns. It comes from the name of its inventor Rin-c'(hhen-)spuns(-pa), who lived in the fourteenth century A.D.

There are also various peculiar ornamental and ritual scripts employed for inscriptions and decorative purposes, titles of books, sacred formulæ, etc.

c. Decoration

There are several decorations to be found on Tibetan manuscripts and prints, which could be on the paper, in the text as lines or drawings, on the wooden boards or on the silk wrappers.

According to Meisezahl[29] vivid inks on the title page indicate special editions, which would be used for the title and its frame, in case of a translation both titles in Sanskrit and Tibetan, the miniatures on both sides of the text and the text frame on the verso.

In exceptionally elaborate editions the title page is protected with a curtain made from silk or brocade, which is attached to the multilayered first page. A curtain might be also found on the inside of the front wooden board, in case it has a depressed miniature carving.

In liturgical texts the introduction Mangala, the worship formula (namaskara), the beginning of the Nidana (place and characters of the occurrence) and other important pieces of text and quotations are emphasized with either a light red or carmine ink and rarely with yellow, or coloured line over the writing.

A greater number of the manuscripts are not illuminated, but many display the fine brushwork of unknown artists. The illustrations usually show the Lord Buddha, the Bodhisattavas, gods and goddesses, and are on the whole far superior in quality to the paintings found

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[29] Meisezahl et al. "Bemerkungen zu tibetischen Handschriften des 17.-19. Jahrhunderts, ergänzt durch die mikroskopische Untersuchung im Institut für Cellulosechemie der technischen Hochschule Darmstadt". p.18.

in comtemporary Jaina manuscripts. The colours are extremly suggestive, the lines delicate and full of refinement. Some manuscripts, in addition, are beautifully decorated with letters of gold.

Astrological and astronomical texts very often include artisticly refined charts for calculations.

Some Buddhist texts, which were originally translated from Sanskrit into Tibetan, show mock holes in their paper leaves. These are imitations of the Indian palmleaf books, which were held together with strings, and pulled through the palm leaves and the wooden boards.

The Tibetan book covers are made of plaques of wood, and the top boards are often generously decorated with carvings and paint or gilt. No specific wood was used. In earlier times (11th to 13th centuries) paintings were more predominant, whereas later in the 16th and 17th centuries ample carvings were mostly to be found[30]. The use of these splendid wooden boards was restricted to a particular group of text of canon, the Prajnaparamita (Perfection of wisdom), which contains the fundamental philosophy of the Mahayana[31].

The silk wrappers of the pothi books are mainly red, orange or yellow, and some are blue or have patterns.

The Tibetan Buddhism is split into several sects, of which the two main schools are the reformed Sha-ser sect or Yellow-Cap doctrine, and the orthodox Rnin-ma-pa sect or Red caps. The book wrappers either in red or yellow indicate to which doctrine these books belong. The orange textiles might be used, in my own opinion, for books which are accepted in both sects.

The dark blue colour is also symbolic and has deep significance. It means destruction and is the colour of the furious aspects of the deities that are the protectors of faith and the destroyers of enemies of faith[32].

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[30] Tucci p. 63-68.
[31] Grönbold p. 380.
[32] Anand pp. 6-13.

Tibetan paper has usually a whitish or yellowish brown colour. Outstanding to these usual papers are the blue-black and yellow papers. The blue-black paper is used for exceptionally elaborate editions with gold and silver writing. As the colour indicates, the text will be certainly a religious one. The yellow paper might indicate a religious text belonging to the yellow-cap sect. As there is no red paper to be found, this statement is quite uncertain.
Heinrich Harrer points out in his travel book[33], that the price of Tibetan books depends on the quality of the paper used. This means that the paper employed for a specific book depended on the choice and the wealth of the person who ordered the book.

2.4. Traditional Storage methods and protection materials

Before describing my own observations, it would make sense to quote statements of others who have written about Tibetan materials, as since 1950 Tibet has been occupied by the Chinese. Therefore it is interesting to read what others have written of their first hand experience in Tibet.

> "The books were of the usual Tibetan form ... bound together by silk cords, and placed between ornamented wooden boards.[34]"

> " The books are not bound. They consist of loose pages printed on both sides and enclosed by two carved wooden covers. ... At home they are generally kept in silk wrappers and carefully looked after.[35]"

> "The covers are generally made of plaques of wood, specially carved with symbols and floral motifs. They are placed one above the folios and the other below. The whole book is tied together and covered with silk cloth.[36]"

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[33] H. Harrer p. 242.
[34] Hooker, p.226.
[35] Heinrich Harrer, p.240.
[36] Calligraphy & Books. p.57-58.

> "The Tibetan libraries contain many thousands of old manuscripts, wrapped in faded silk, held in place between board covers and piled in phalanxes to the ceiling. But to remove the manuscript at the bottom of a row is an arduous task requiring the service of many hands. The room is invariably poorly lighted and in winter is extremely cold.[37]"

The pothi book as described above is either:
- bound together by silk cords and placed between wooden boards, or
- covered with wooden boards and then wrapped in silk, or
- wrapped in silk with boards placed on top and held together with a cord of silk or leather.

I have seen the second and third possibilities in two different Tibetan settlements in India. Very often, the books were covered with cotton instead of silk. These wrappers are made from two layers of textile sewn together, with a coloured layer outside and an inner one usually white or undyed. They are in a rectangular shape, with its corners folded inside on top of the book.

The bound book is covered with undyed cotton cloth, in this context the cotton can be seen as the protective material for the text block.

The books were either stored as Sankrityayana described, or in "pigeon hole" like shelves, where every book had his own space.

Title labels are either strips of brocade or paper which is slipped between the folds of the wrapper and protrudes at the smaller end of the book.

Storage conditions have been always favorable for books in Tibet, as the climate is dry and cold, and the air was free of pollution because no cars or factories were to be found in Tibet until the Chinese invasion.

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[37] Sankrityayana, pp.27-29.

No.5 Library of Tibetan Works and Archives, Dharamsala, India.

No.6 Library of Tibetan Works and Archives, Dharamsala, India.

No. 7 Thupten Mindolling Monastery, Orissa, India.

No. 8 Thupten Mindolling Monastery, Orissa, India.

a. Their origins

There is archaeological evidence of cotton textile industry at Mohenjo-Daro (India) in the Indus Valley around 3,000 B.C., and a few fragments survive from much later periods. There is no evidence to be found as to, when cotton production was introduced into Tibet and it is a certainty that cotton does not grow in this country. In China during the Sung dynasty (960 - 1279 A.D.) agricultural innovations, including cotton cultivation and advanced manufacturing techniques raised the standard of living.

Silk was made first in China about five thousand years ago. It is said, that the Chinese empress Hsi-Ling-Shi (2,640 BC) first discovered the potential of the silkworm, when a wayward cocoon was carefully retrieved from the princess's cup of tea. Silk reeling is thought to have started in China during the time of Fouh-hi. The invention ot the loom is generally attributed to Empress Si-ling-chi, the wife of the celebrated Hoang-ti (2,602 BC).

Silk is a natural product which is the secretion from the mouth of a moth caterpillar. It is commonly thought that the original species does not now survive in the wild and that its continued existence is assured only by its culture by man. In the wild, the silkmoth lays its eggs on mulberry twigs where they overwinter until the buds open in the spring, thus its assuring survival. This single generation, with a resting stage over the winter, was the basis for domesticated silk production for thousands of years.

China held the key to silk production and maintained its monopoly over the rest of the world for at least 2,500 years. In India Bombyx silks have been produced for at least the past two thousand years, and their own silks from the native wild Tusseh silkmoths for about five thousand years. The point of which silk was introduced into Tibet is not known, but probably with the Great Silk Road, a network of routes that linked China with Syria, Asia Minor and India, where silk had been traded since the 4th centry B.C.

Wood is far less uncommon in Tibet than is sometimes supposed, though large parts of the country are above the tree-line and transport between the central valleys and the wooded regions, mainly in the south-east, along the Himalayan slopes and below the northern uplands, is not easy. The willow and poplar, as well as fruit trees such as apricot, peach, pear, apple and walnut, are quite common[38]. Hazel and birch are also to be found.

According to Fred Marsh[39] no specific wood was used to make book boards, but there are planks of the Indian Nim tree to be found. Walnut is employed most for the preparation of wood blocks for printing.

b. Their function

Craftsmen were employed within Tibet for secular and religious purposes perhaps from a very early period and certainly from the time that the central monarchy was established under Srong-brtsan-sgam-po (627-650).

Cotton was not often used in Tibet, and today it might be a cheaper, modern replacment for silk. The traditional dress was made of sheepskin and wool, imported broadcloth, satin or silk. In this context satin means silk again from the Chinese word "ssu tuan".

Paper moulds were always made from cotton cloth, and silk or cotton were used as support for thankas.

Silk has extraordinatry properties, which is why it has many uses besides being a precious material. Silk has a high tensile strength, and is said to be stronger than a filament of steel of equivalent dimensions. Silk threads can be readily expanded to 20 - 25 % of their natural length. Bundled or folded up silk reduces to extraordinary degrees, its chemical compositon allowing it to bounce back again very quickly. Silk is one of the lightest of all natural fibres, is more heat resistant than wood and if deliberately burnt, will decompose at 340°F, 171°C. Silk has a hydroscopic nature, the amino-acids within its structure allows it to absorb considerable

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[38] Shakabpa, p. 3.

[39] Head of the conservation department at the India Office, British Library.

quantities of water before the material feels damp. Various authorities claim that it can absorb from one-third to three times its weight in water. When the amino-acids take on water vapour they hydrate and give off a small amount of heat, this helps in the cooling process. The advantage in cold environments is that silk offers a useful insulation layer. Silk padding is used in some military clothing, and in many ski clothes. Silk has a great affinity to dyes and produces more permanent (fast) and richer colours than other materials. Silk does not rot, and this attribute is advantageous when it is used as stitching material by surgeons.
In Tibet silk was mainly employed for dressmaking, ordinary national dress was functional and unpretentious but a "best" garment might be of the finest imported material. Ecclesiastical and secular clothing showed the greatest variety and splendour. Wealthier or higher clergy might wear garments far removed from the apostolic simplicity of Buddhist ideals, religious dancers and oracles wore the finest silks and noblemen and officials had formal dress which was distinguished by its costliness and the variations employed to express rank.

Wood was widely used in Tibet in building for beams, pillars, doorways and furniture, wooden images however are not commonly reported or found. Articles of religious use are nevertheless frequently found to be made of wood, these include portable altars, ritual daggers for protection against hostile spirits or boxes for every day life and wood-blocks for printing.
The Indian Nim tree is known as an insect repellant, and for most people in India as a medicine. At the Hindu New Year's day, young leaves are eaten to ward off sickness during the coming year, and young branches of the nim tree are sold on the streets of India as tooth brushes.
The application of wood for religious articles used in rituals speaks for itself. The Nim tree and Bodhi tree have their own significance. The Nim tree is sacred to the Hindus, presumably due to its medical use. This tree does not grow in Tibet and there is no

indication of religious significance in Buddhism, but as many ideas have traveled from India to Tibet its medical use might be one of them. The Bodhi tree or Ficus religiosa grows in India and is sacred to the Buddhists. It is rarely used and only in consecration circumstances.

Any of these materials mentioned are used for the consecration of a Lamaist sculpture, as Leonov[40] describes:

"(This) is done by putting several relics inside an image. The first item to be put inside a sculpture is a srog-shing or tree of life - the axis of the sculpture. Usually a srog-shing is a thin wooden stick, square at the bottom and narrowing to the top. After the srog-shing is inserted, it is fixed horizontally by filling the sculpture with a brownish aromatic powder rammed in around the srog-shing. Together with the powder, scrolls with dharanis are put inside in accordance with the rules which prescribe that scrolls are to be placed at certain parts of the image (in its head, at the waist level, in the throat, etcetera). ... A rolled scroll usually was wrapped in a piece of silk, sometimes in a piece of cotton. ... Sometimes powder was packed in small silk or cotton bags, tied or sewn up after being filled. ... In some sculptures, pieces of metal and shells, small stones, coins, beads and even small sculptures could be found. ... At the end of the procedure of consecration, mandala or (Sanskrit: circles; Tibetan: 'khor-lo) are inserted, which were usually made out of paper, and sometimes from silk. ... As a rule, 'khor-los are the last item inserted into an image. After them the last layer of aromatic powder is put in to cover the relics. Then the contents were carefully covered with a large piece of silk, usually yellow or oragne, after which the image was closed using a metal plate with a vishvavajra engraved on its outer side. ... The plate, together with the piece of silk, provided in many cases for good preservation of relics inside the sculpture."

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[40] Leonov p.100-110.

3. Description of material

The following material was generously put at my disposal for research and conservation treatments. The Horniman Museum (H.M.) provided me with four paper prayer scrolls from prayer wheels, from the Royal Asiatic Society (R.A.S.) I recieved four books, and from The Wellcome Institute For The History of Medicine (W.I.) two books.

Horniman Museum No.: NN 1697 with prayer-wheel

A paper scroll which is printed in black ink on white paper on recto and verso. It is made from one piece and its dimensions are 57 x 873 mm.

The inscription on the scroll are different mantras: "Manjushri, Avalokite's vara, Vajrapami, Amitayus, White Tara, Vijaya". They are aspirational prayers for good furtune, prosperity and good health.[41] The scroll was still in its metal prayer-wheel rolled around a bamboo pin. The prayer wheel needed conservation treatment due to deterioration, which meant that the paper scroll had to be removed for this purpose. The prayer wheel was returned to the Horniman Museum for conservation.

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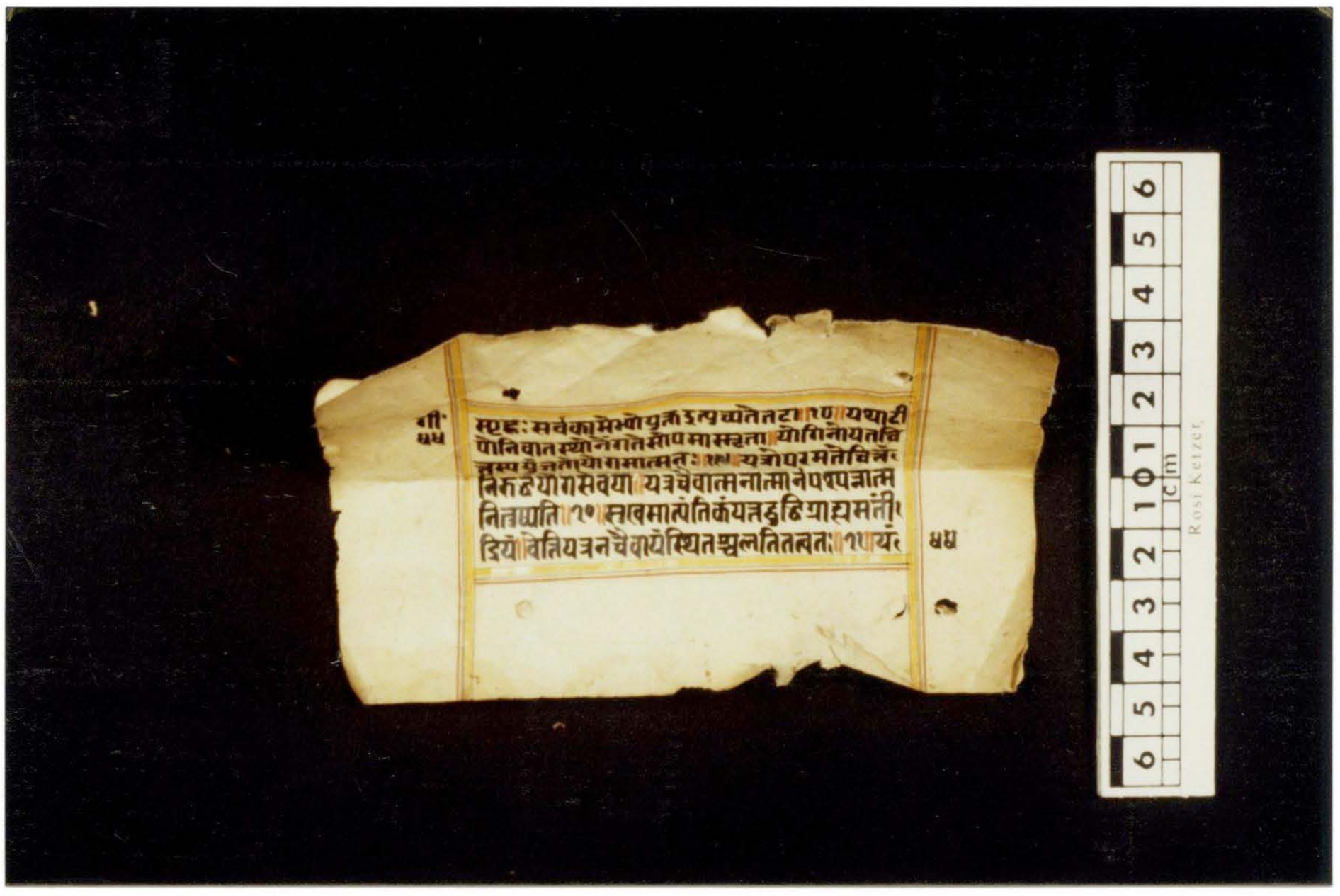
[41] Translated by Mr. Gyurmi Dorje and Mr. Tudeng Nima, School of African and Oriental Studies London.

No.9 Horniman Museum NN 1697 Paper scroll in the prayer-wheel.

No.10 Horniman Museum NN 1697 The prayer-wheel.

Horniman Museum No.: 1983.90

This paper scroll is a folio from a book. It is folded in the middle and rolled to fit into the prayer wheel. It is a manuscript written in black and red ink with a yellow and red frame painted on a paper in a brown tone on recto and verso. Its dimensions are 87 x 137 mm. The folio is part of some Sanskrit verses, a religious Buddhist song, which starts in the middle of verse 15 up to verse 21. It is written in a Deva Nagari script, in a very elegant and skillful manner[42].



No.11 H.M. 1983.90 Book folio folded and rolled into scroll form.

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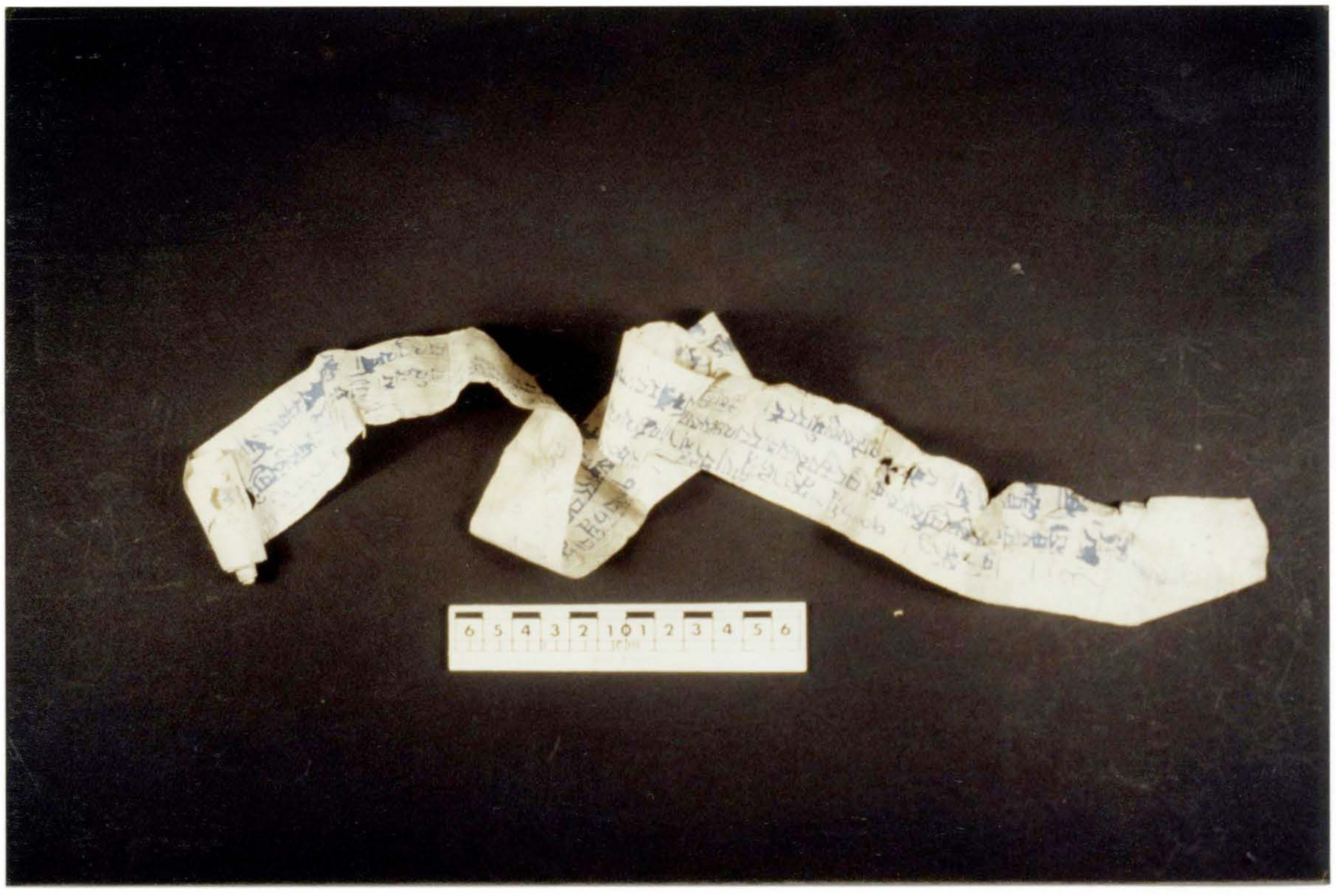
[42] ibid.

Horniman Museum No.: NN 1696

The paper scroll is a manuscript written in blue ink on white paper on recto and verso. It is made from one piece and its dimensions are 41 x 1167 mm.

It is a Sutra, for the confession of sins and negativity.[43]



No.12 Horniman Museum NN 1696 Paper scroll.

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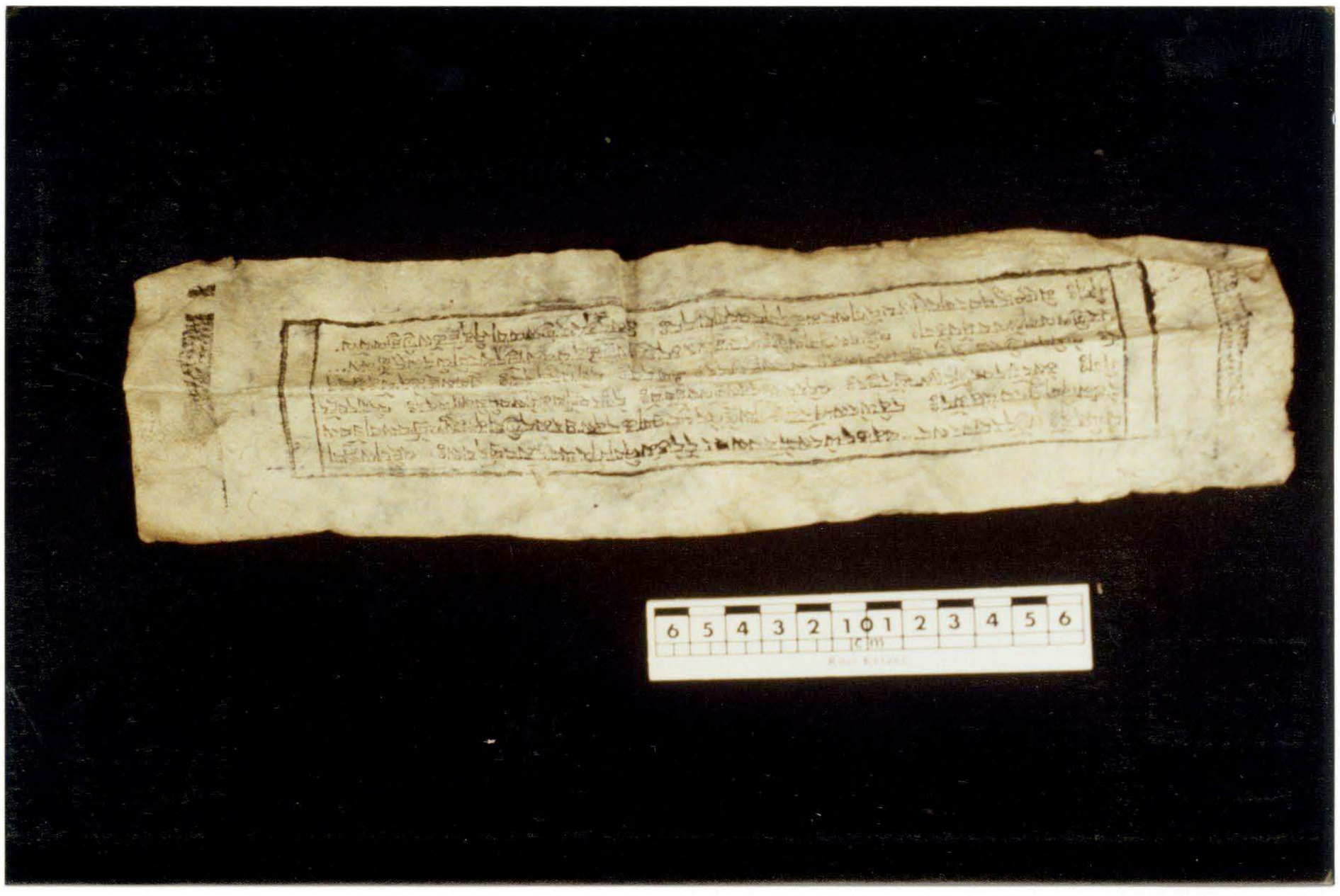
[43] ibid.

Horniman Museum No.: 6.12.65/65

This paper scroll is a folio from a book. It is folded in the middle and rolled to fit into the prayer wheel. It is printed in black ink on white paper on recto and verso. Its dimensions are 90 x 330 mm. It is a teaching, clarifying the stage between death and rebirth, from the "Book of the Death".[44]



No.13 H.M. 6.12.65/65 Book folio folded and rolled into scroll form.

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[44] ibid.

Royal Asiatic Society No.: Manuscript 5

This is a collection of manuscript folios kept in a pothi book form with two pieces of cardboard as covers. The manuscripts are mainly written in black ink with red or brownish lines on white paper recto and verso, but folio 42 is a title page written in yellow ink on dark blue paper. There are 58 folios in sixteen different dimensions, the smallest being 134 x 412 mm, and the largest 201 x 601 mm.

They are fragments, negligently written on coarse paper.

(1) Sign (2). Fol. 25, 30 - 33, 41.

(2) Sign (14). Fol. 3, 20 (?), 23 - 30, 32, 34

(3) Sign (17). Fol. 6 - 12. Firm writing.

(4) "Subhabusmatamgha, Gser od dam · pai sna rgai gruns." Fol. 14, lines 6 (desunt 4, 11), signed W (24), and, from fol. 7 on I. (25).

(5) "Çatasahasrika prajña paramita." Fol. 2.

(6) Fol. 1. End folio, number 10, lines 2.

(7) "Vajracchedika." Fol. 1.

(8) "Vajracchedika." Title page yellow on blue. 1 fol., and 16 stray folios from different works.[45]

This book is a donation from Brian Houghton Hodgson (1800-1894) who lived in India and Neapl from 1818 to 1858. In 1876 he was elected a Vice-President of the Royal Asiatic Society.

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[45] Catalogue of the Royal Asiatic Society.

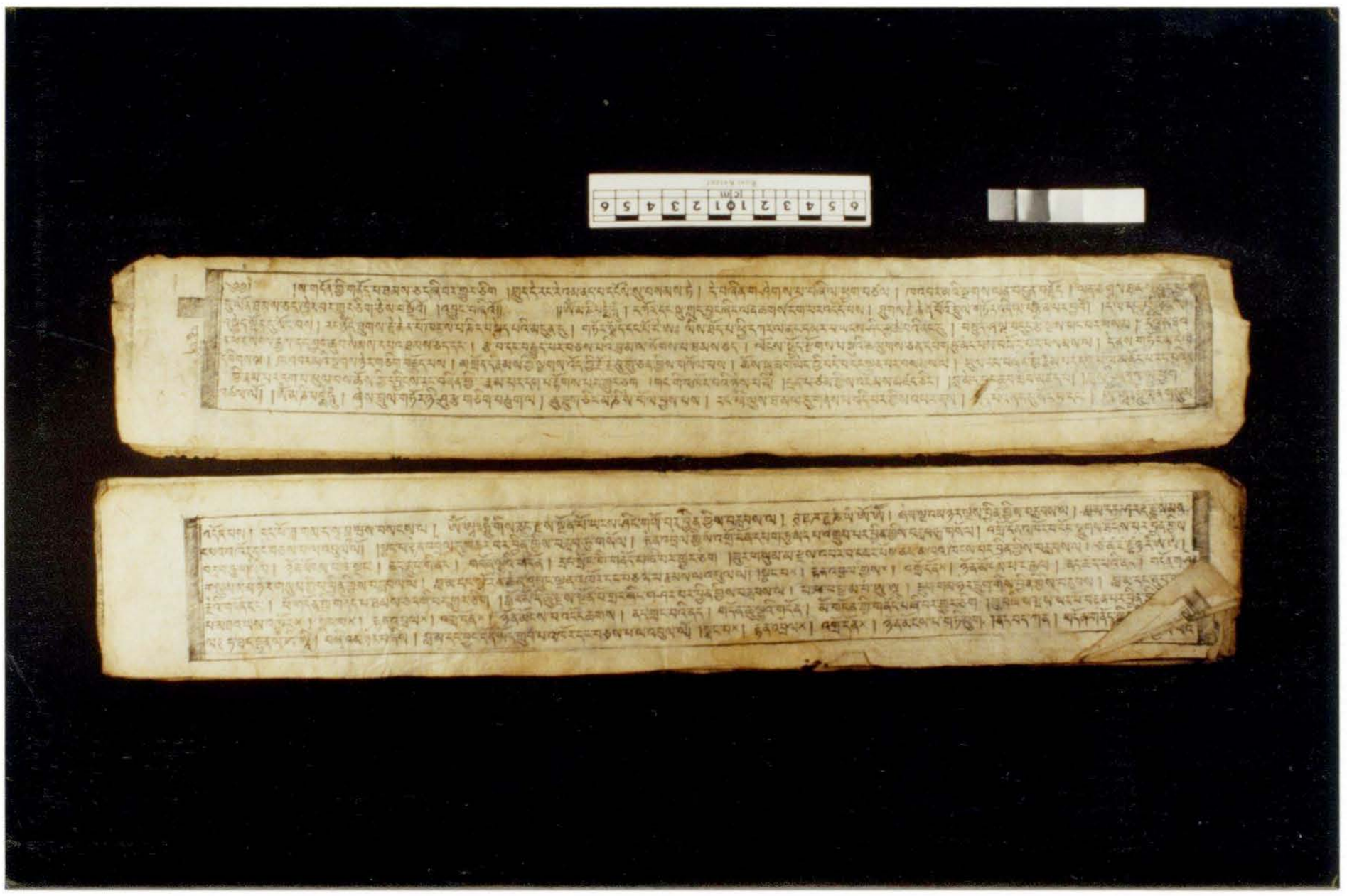
No.14 R.A.S. 5 A collection of manuscripts kept in a pothi book.

Royal Asiatic Society No.: Print 7

This is a pothi book printed in black ink on white paper on recto and verso. The dimensions are 86 x 505 mm. There are 16 folios with seven lines to a page.

The title is "Rgyun · gtor khrigs · su bkod · pa" (Coherent exposition of perpetual offering). It is a ritual.[46]

The book is a donation from Brian Houghton Hodgson (1800-1894).



No.15 R.A.S. 7 Printed pothi book.

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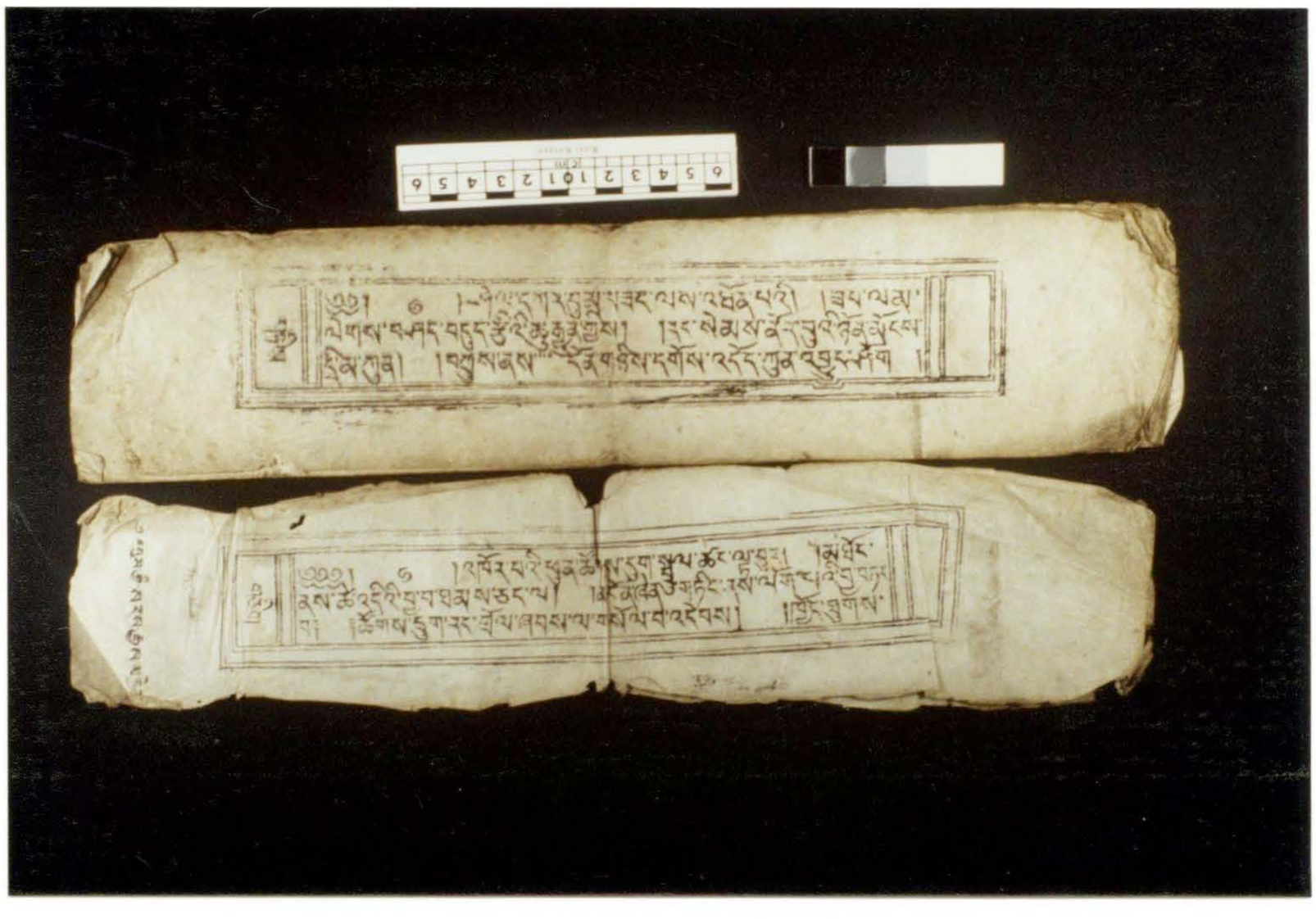
[46] ibid.

Royal Asiatic Society No.: Print 12

This pothi book has six folios. It is printed with black ink on white paper. Each folio is only printed on recto and double folded over at the head, which is the longer side. Its dimensions are 90 x 406 mm, and the unfolded sheet 180 x 406 mm. There are four lines to a page.

Its title is, "Bla · mai gsol debs sbyin rlabs myur jug" (The Guru's prayer: Quick entrance to blessing). The book is complete.[47]

This book is a donation from Brian Houghton Hodgson (1800-1894).



No.16 R.A.S. 12 Printed pothi book.

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[47] ibid.

Royal Asiatic Society No.: Print 13

This pothi book has nineteen folios and two large drawings. The first thirteen folios plus one other folio within the manuscripts are printed in black ink on white paper on recto and verso. Five folios are manuscripts with mystical diagrams of human figures, and calculations written in black and red ink on white paper on recto and verso. There are four different dimensions of folios, the smallest are 72 x 450 mm, and the largest 91 x 486 mm. The dimensions of the drawings are (p.20) 510 x 490 mm and (p.21) 455 x 479 mm.

The title of the book is "Dohakoçanama maha mutra upadeça". There is a title page and a title page of another work, and the printing is blurred and unrecognisable.[48]

The book is a donation from Brian Houghton Hodgson (1800-1894).

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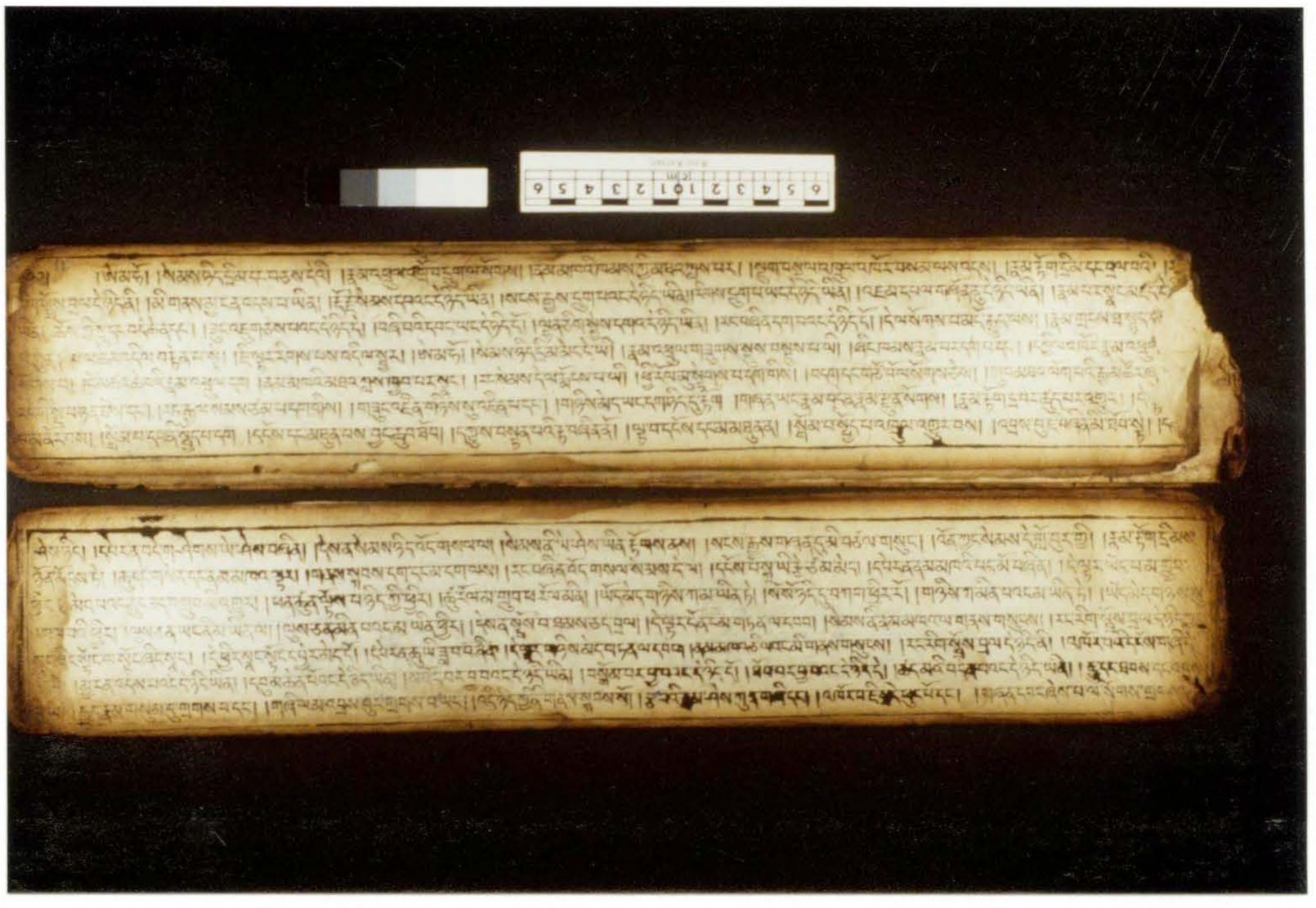
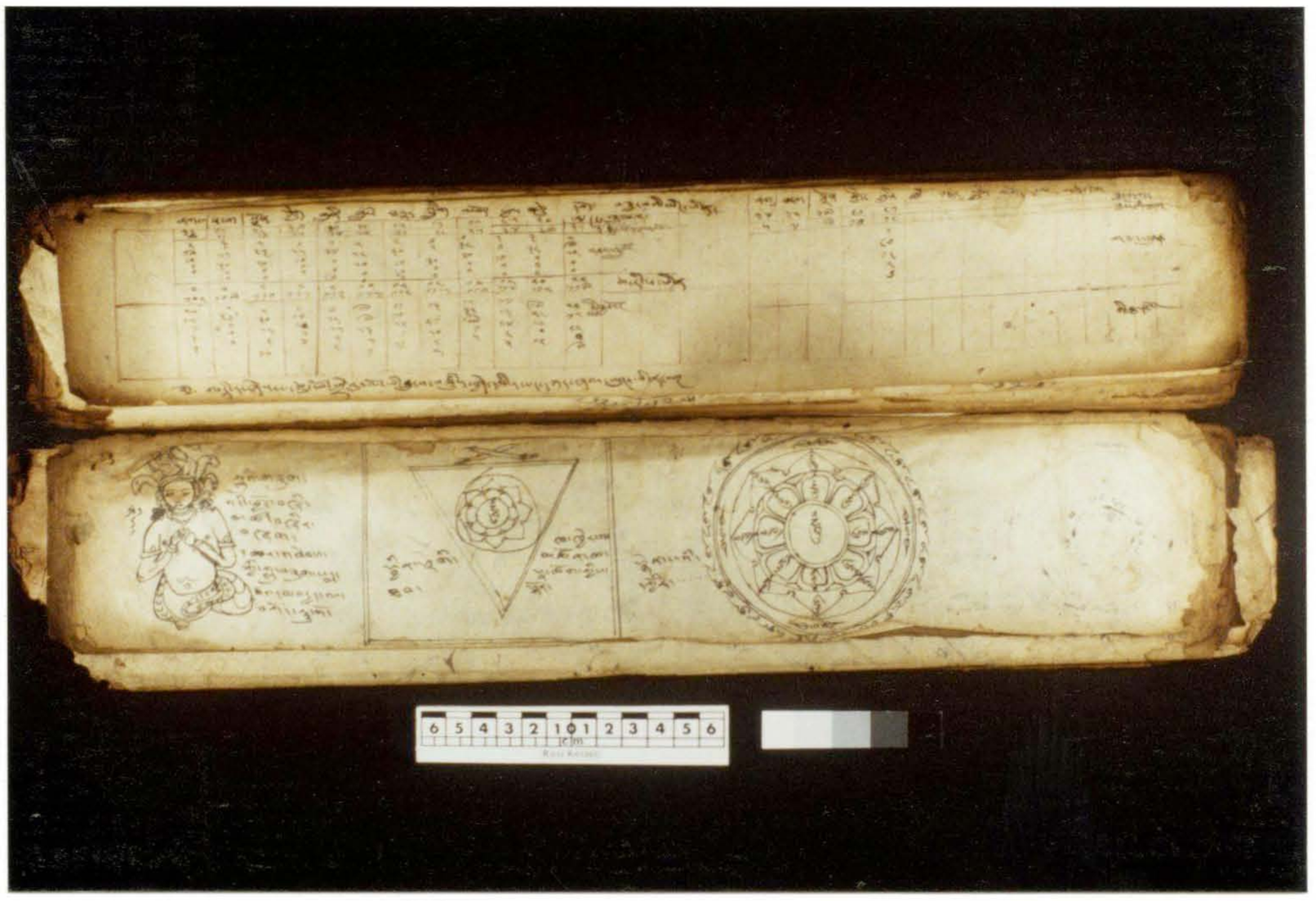
[48] ibid.

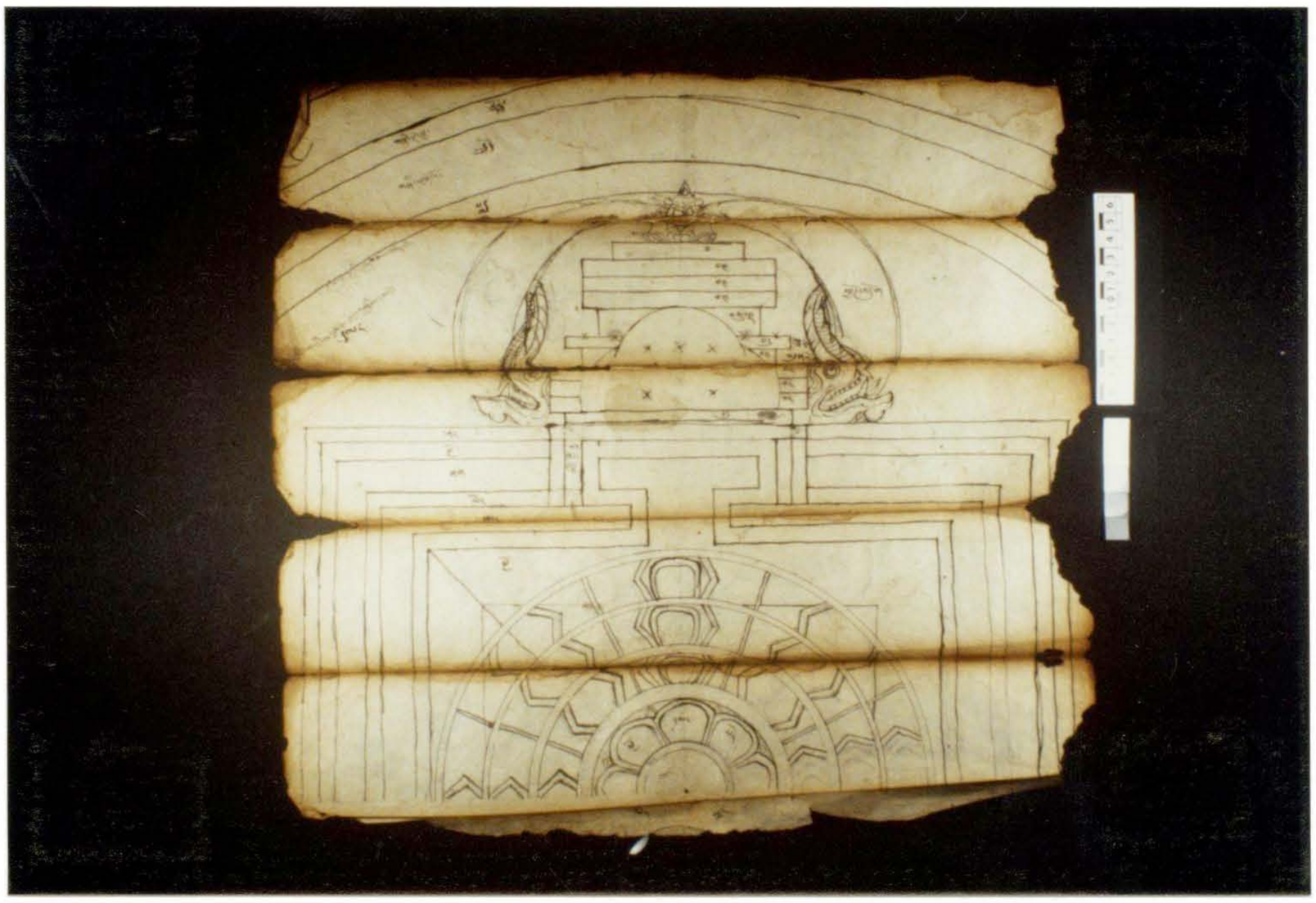


No.17 R.A.S. 13 Pothi book.



No.18 R.A.S. 13 Pothi book.

No.19 R.A.S. 13 Large drawing part of the pothi book.



No.20 R.A.S. 13 Large drawing part of the pothi book.

Wellcome Institute No.: Tibetan 11b

This pothi book is a manuscript written in yellow and white ink on dark blue paper. The centre of the paper is polished. There are thirty folios with the dimensions of 109 x 337 mm. Five lines are written to a page in the style of dbu-chan on recto and verso. The title page has a green silk curtain and a paper mount to protect the writing. The book has painted wooden boards with bevelled edges on the longer sides, and carvings on one edge of the shorter sides. The dimensions of the boards are 115 x 340 mm. There is a white leather strap with a metal buckle to hold the book together.

The title is, "Rdo jde rnam par 'joms pa'i gzuns, Vajravidarananamadharani" (Incantation of all conquering indestructible reality) translated by Jinamitra, Danasila and Ye-ses-sde.

The book was purchased at Sotheby's on 31 October 1933.[49]

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[49] Catalogue of the Wellcome Institute.

No.21 Wellcome Institute 11b Title page of the pothi book.

No.22 Wellcome Institute 11b Front book board of the pothi book.

Wellcome Institute No.: Tibetan 38

This book is a manuscript written in black ink on white paper, with different coloured strokes in water colour above the writing. Its dimensions are 104 x 226 mm. It is bound in undyed cloth (104 x 226 mm), and has no boards or end papers. The book is folded and bound at the longer head side. It is made up in five gatherings with 91 folios of which 32 folios are blank. Every gathering has a cloth joint at the outer double page. The book is sewn together with two threads in cattle stich. There is a twisted thread attached to the sewing to hold the book together. The text is written in the dbu-med style. There are four lines to a page.

The title is "Official record of tribute paid to Lhasa by the Phari district during a series of years." The first page is dated[50], "2nd day of 9th month of the iron male horse year" (1870).

On the manuscript the different coloured strokes in water colour indicate the years in which tax was paid. For every year another colour was used.

The previous owner was L.A. Waddell. Marked on a handwritten label pasted on the cover by Wadell: "Found at Phari Fort in 1904". The Wellcome Institute purchased the book at Sotheby's on 29 November 1920.[51]

For a complete description of the items see the conservation documentations at Appendix II.

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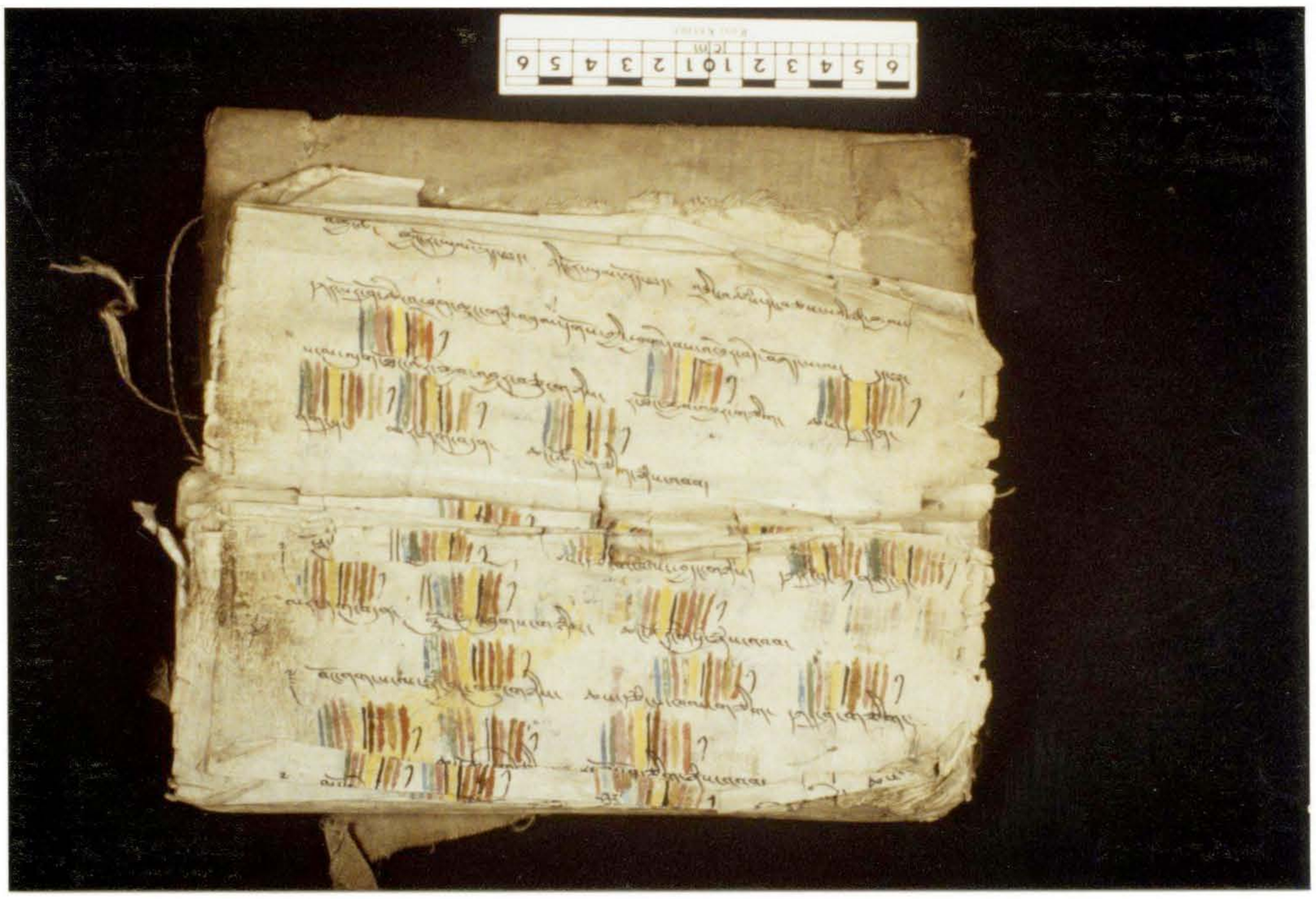
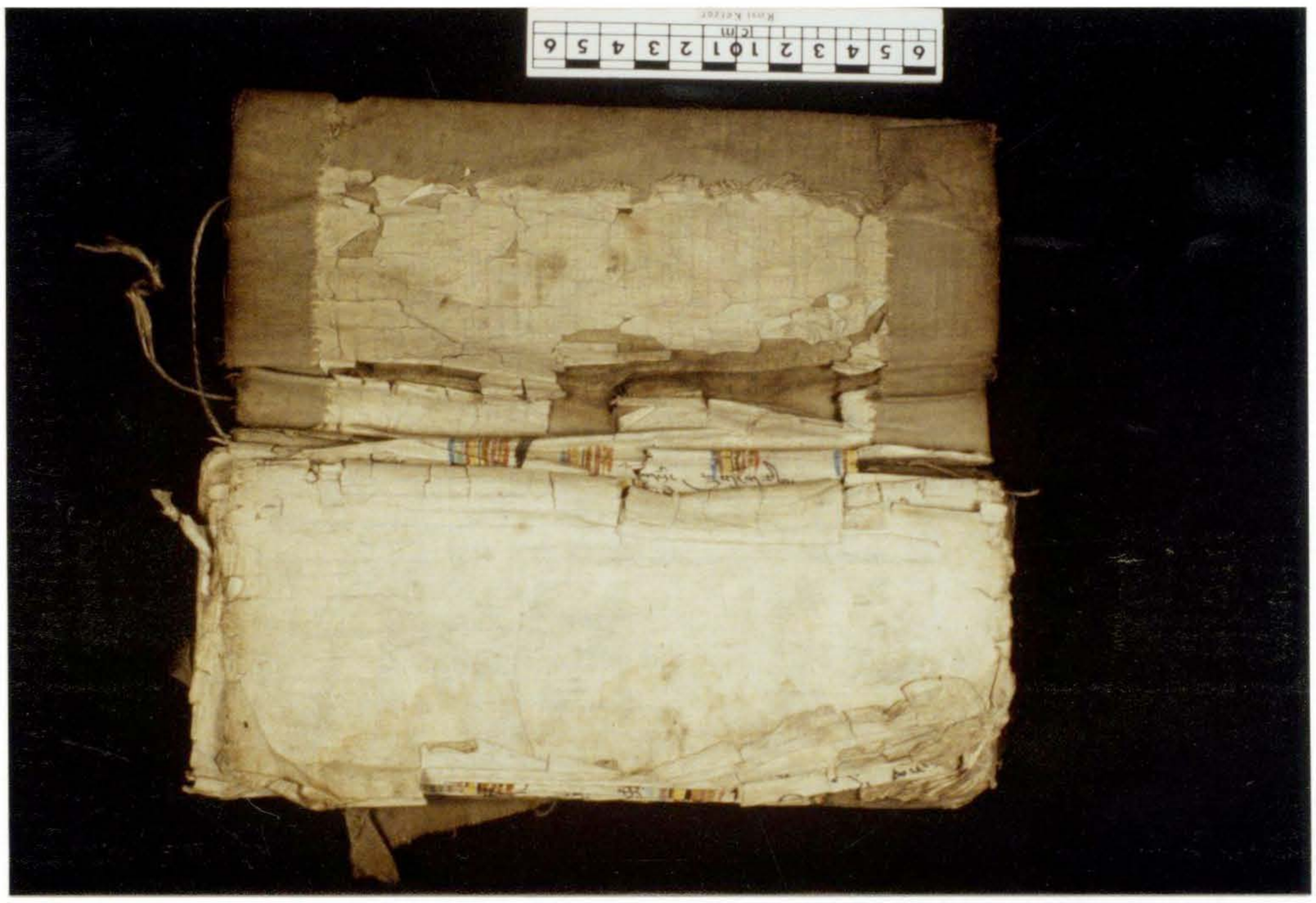
[50] Translated by Mr. Gyurmi Dorje and Mr. Tudeng Nima, School of African and Oriental Studies London.

[51] Catalogue of the Wellcome Institute.

No.23 W.I. 38 Front Cover.



No.24 W.I. 38 Text Block.



No.25 W.I. Inside of Front Cover.

8. Conservation review

Tibetan approach

In Tibet books of value are often traditionally copied and the old ones are then destroyed. Nevertheless I have seen some coarse repairs made on Tibetan papers, but conservation itself or publications about conservation are not existant in Tibet.

Indian approach

O.P. Agrawal was the director of the "National Research Laboratory for Conservation of Cultural Property" in India and is now the director of INTACH (Indian National Trust for Art and Cultural Heritage), both are leading conservation institutions in Asia. He[52] describes the Asian view of conservation as follows:

> "Art in Asia usually had a religious purpose; the meaning of the art as such, and its physical form, did not have much importance. Because of this basically different psychological approach towards art forms, it hardly mattered to the ordinary man if a broken image was replaced by a new one; in fact, if broken, it could not continue to occupy the main sanctum of the temple. An image or a religious work of art was not considered as a piece of decoration or something intended for specifically aesthetic enjoyment. Hence, there was no objection to a painted sculpture being repainted, and this was indeed done year after year without in any way offending the aesthetic feelings of the people. It was not that they lacked aesthetic sensibility, it was simply that they had a different conception of works of art. They simply did not see why it should be necessary to preserve and maintain decaying paintings on the walls of temples, feeling that it would be just as well or even better if the old painting were scraped off and the work done anew."

O.P. Agrawal hopes for a change of understanding to the museological way of conservation, and calls it the modern philosophy of conservation.

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[52] O.P. Agrawal (1975) p. 157.

I have visited both institutions in Lucknow (India) and was impressed by their standards. But basically one can speak of a Western approach of conservation.

Western approach

There are many publications about the conservation of Tibetan thangkas, some about the conservation of Tibetan metal objects, and a few about Tibetan textiles. But I could not find any about the conservation of Tibetan books and manuscripts.

5. Ethical considerations

Before conserving Tibetan books, manuscripts or scrolls from prayer-wheels ethical considerations should be taken into account.
There are different attitudes towards religious objects. In museums, archives, and libraries one tends to interpret these objects exclusively from a scholarly and museological point of view. To the people who made and used the religious objects, they represent primarily devotional values and sometimes even magical powers. An object of worship in a living religious traditon changes into a document from which one may extract information about that tradition. Moreover, once in a museum, many religious objects are regarded principally as works of art, as typical or rare examples of a certain style, technique, iconography or artist.
But there are also different approaches, for example in 1979 the Tropical Museum in Amsterdam designed a new permanent exhibition in its South East Asia department. One part of this exhibition consists of a small temple-like structure, erected to display an altar and several statues of Buddha. The Dutch Buddhist community, whom regards the Buddha statues as holy images, expressed the wish to keep them in a consecrated room. The Tropical Museum, in agreement with this wish, invited members of the community to perform the necessary ceremonies and thus - one afternoon before the exhibition was opened - twenty Thai monks from a Buddhist monastery in Waalwijk in the Netherlands, came to the museum and consecrated the little temple through prayer and chanting[53].
Chandra L. Reedy has written a fine article on the opening of consectrated Tibetan bronzes, including the ethical opinions of eighteen prominent Tibetan religious teachers, who commented on these treatments. The bronzes were hollow-cast statues of Buddhas or other Tibetan deities, which had objects sealed inside them. Chandra L. Reedy carried her survey out after having already opened several statues. She was also aware that her items of research were consecrated.

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[53] A. Weersma pp. 567-570.

Here is an extract from Chandra L. Reedy's publication[54]:

> "None of the Tibetan leaders were comfortable with the opening of statues in a museum context. Two felt, however, that it was not a complete desecration. The others held strong opinions that statues should never be opened for museum study. Venerable Karma Gelek Yuthok, deputy secretary of the Council for Religious and Cultural Affairs of His Holines the Dalai Lama ... (states): It is not difficult to understand the good reasons of museums and curators for opening consecrated statues. But the validity of these reasons may or may not be sound when judged from the religious point of view. The very practice of treating consecrated statues or other religious objects as mere pieces of art amounts to a gross violation of a most basic Buddhist practice. ... One acceptable opening procedure described by the Sakya Monestery of Seattle (called a chog and pronounced "a choke") is used in Tibet when statues must be repaired. In a special ritual involving a mirror, the blessing the statue receives when consecrated is transferred to the image in the mirror. When the work on the statue is completed, the blessings are transferred back from the mirror image to the statue, which should then be reconsecrated within a month. The Sakya monastery also emphasized that it is important that conservators and scientists who work with Tibetan Buddhist objects show respect for the image as a religious object so that the practitioners will not be offended or upset by the treatment accorded the object in the museum. For them, this means that the image should be treated with care, kept in a clean area, not put on the floor or stepped on, and kept slightly elevated if possible."

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[54] C.L. Reedy pp. 30,32.

No.26 Horniman Museum No.1320 Consecrated statue. Lama of the Red Hat sect. Painted clay.

In another publication[55], five Germans were comissioned to restore frescoes in two Buddhist temples in Ladakh, northern India. The local community, who still uses these temples, did not initiate the restoration. The frescoes were damaged and barely readable because of dust and soot. Consequently, the artistic quality of the paintings was seriously impaired, that is, from the western point of view of the sponsoring organization. To the people who created the frescoes and still use them in their religious ceremonies, these problems are not at all relevant. According to their Buddhist views, in which the cycle of death and rebirth is essential, religious images do not lose meaning or value as they decay. They represent on a symbolic level "another reality" that remains ever present in the picture, regardless of its material condition. Therefore, the

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[55] H. Portsteffen, Y. Erb and B. Will pp. 76-83.

frescoes in the temples of Ladakh are never restored. They are simply left alone or they are newly painted according to ritual methods that preserve their mystic representation value. Only certain priests and monks are permitted to perform this task and they do so in strict adherence to ritual prescriptions of form, colour, working order, materials, techniques, prayers etc. Certain materials for example, should not be used because they are unclean. To ignore these considerations meant a serious desecration of the temples. Out of respect for the people from Ladakh and their religious tradition that is still very much alive, the restorers decided not to treat the frescoes.

Statements concerning the conservation of Buddhist wallpaintings or sculptures of deieties did not clarify my questions concerning the conservation of Tibetan books, manuscripts and scrolls from prayer wheels. As I could not find publications on this matter I approached the School of Oriental and African Studies (SOAS) University London.

My questions were as following:

- Are books and manuscripts or prayer wheels consecrated?
- As a Non-Buddhist am I allowed to touch or treat these items?
- Are there any materials, which should not be used within the conservation process, because they are considered as unclean?
- Should these items be conserved at all?

Dr. Philip Denwood, Tibetan expert at the SOAS, gave me his opinion on the conservation of Tibetan artifacts. He said that the most important point was that the religious items should be treated with the utmost respect, and if possible kept in a slightly elevated position. Otherwise, he considered there was no problem in my touching or conserving Tibetan books, manuscripts or scrolls from prayer wheels. He also pointed out that a Tibetan would probably not bother to conserve an item, prefering to make a new one, copying its predecessor.

I was finding it difficult to get in contact with Tibetans, and as the person I was looking for should not only have the right

nationality, but should also be a Buddhist scholar and know something about museums. With some difficulty I managed to arrange a meeting with Mr. Gyurmi Dorje and Mr. Tudeng Nima, both scholars at the School of African and Oriental Studies writing a Tibetan-English dictionary. According to them a Tibetan book or prayer wheel would have been consecrated if it was part of a shrine, because the shrine would be consecrated as a whole. They did not see any reason why I should not touch or treat these items, being a non-Buddhist. They also could not think of any materials considered as unclean or should not be used in the conservation porcess. I thought a Buddhist would not eat meat and therefore materials made from animals would be prohibited, but it is all a question of interpretation. According to Mr. Gyurmi Dorje and Mr. Tudeng Nima a Tibetan would make a prayer-wheel from yak skin if he could afford it. From their point of view the conservation of Tibetan books and scrolls would be appreciated, as normally damaged books would be copied and then destroyed or either burned or kept in a stupa to retain a sense of respect for the material.

To clarify my questions fully, Mr. Tudeng Nima told me a Tibetan story:

> "There are three men. The first man builds three clay stupas. Then it starts to rain. The second man comes along and thinks the clay stupas will be destroyed by the rain. So he puts his shoe soles on top of the stupas. The third man comes along. He thinks it is unappropriate to see the soles on top of the stupas, and removes them."

6. Analysis of paper, ink and pigments

The analysis of paper was the main interest of this thesis, whereas the analysis of pigments and inks was more peripheral, as a book and archive conservator would not retouch missing areas. My curiosity was raised by item No. W.I. Tibetan 38 which has very bright and colourful strokes in water colour above the writing, and item No. W.I. Tibetan 11b which is a manuscript written in white and yellow ink on dark blue paper. I did not attempt to identify every pigment. Before analysing Tibetan manuscripts and prints it is useful to discover what information is already available. It seems that the scientists concerned with the research of Tibetan paper are a small comunity, who refer in their publications to each other. The literature concerning pigments could only be used for research on thang-kas. Also as Tibet was always a closed land with "forbidden frontiers", the information coming out of the country itself was very sparse, and might be intermingled with folklore.

6.1. Literature survey

a. Paper fibres

There are several publications about paper analysis and paper descriptions with the following fibres given as the contents of the Tibetan papers.

According to Grönbold[56] Tibetan papers were always made exclusively from plant fibres, whereas in China rag was also used. He points out that 8th and 9th century Tibetan paper, which was found in Central Asia at the beginning of the 20th century is almost certainly Chinese, because it contained traces of rag.

Meisezahl, Harders-Steinhäuser and Jayme[57] analysed a 18th century Tibetan paper, and identified the fibres as the East Asian Daphne fibre: the Thymelaeaceae Daphne lagetta Sw. - Lagetta lintearia.

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[56] G. Grönbold, p.366.

[57] Meisezahl, Harders-Steinhäuser and Jayme. "Über den Derje Tanjur der ehemaligen Preussischen Staatsbibliothek." p.300.

Afterwards they commented on their research by adding, that it seems to be nearly impossible to distinguish between the two bast fibres Wikstroemia und Daphne according to their similar anatomic structures. Therefore they corrected themself by saying, that the fibre is certainly Thymelaeaceae, and probably Daphne or Wikstroemia. The paper also contained impurities, which were identified as bud and leaf tissue. Meisezahl, Harders-Steinhäuser and Jayme[58] identified two more papers. The first was a four-layered paper, with outer layers made from Broussonetia fibres and some bamboo. The inner layers were made entirely from bamboo. The fibres of the second paper, which is black, were identified to be almost certainly Edgeworthia, and the sklerenchym cells as Daphne. In an other publication by the same authors[59] they indentified the fibres of a three-layered paper from south Mongolia. The inner layer consisted of loosly connected fibres from Broussonetia and the bast fibrous tissue of mulberry. The fibres of the outer layers were close together and made from bamboo fibres.

Sandermann and Funke[60] made chemical analysis of the black Tibetan paper and found Daphne fibres. Trier[61] analysed 22 paper samples from books written in Tibetan, and identified 16 samples as being made entirely from Daphne bholua, two samples were made soley of Edgeworthia gardneri, three were a mixture of Daphne bholua and Edgeworthia gardneri and one was made from Wikstroemia chamaejasme. Hunter[62] mentions in his book the use of mulberry (Broussonetia papyrifera) as the fibre used in Tibetan papermaking.

According to Koretsky[63] the plant Stellera chamaejasme has been used for centuries in traditional papermaking in Tibet. Stellera is an herbaceous plant with a woody rootstock, a member of the Thymeleaecaea family of plants. Stellera is unique among them, however, in that the root of the plant contains the bast.

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[58] id. "Alttibetische Handschriften im Reiss-Museum, Mannheim". pp.15-18.

[59] id. "Die Tibetischen Handschriften und Blockdrucke im Antwerpener Ethnographischen Museum." pp.18-26.

[60] Sandermann and Funke, pp.41-43.

[61] J. Trier, pp.245-246.

[62] D. Hunter, p. p.59

[63] E. Koretsky, p.2.

According to Grönbold[64], if Moraceae fibres (mulberry) are found in the paper (especially Broussonetia papyrifera), the paper was originated from areas close to China, because this is a common waste product from silk worm breeding.
All these fibre names seem to be very confusing, when one is not entirely familiar with botany. Domke[65] investigated these plants and came to the following description:

Family: Thymelaeaceae
Subfamilies: Gonystyloideae, Aquilarioideae, Gilgiodaphnoideae, Thymelaeoideae.

Thymelaeoideae is divided into four tribes.

Tribes: Dicranolepideae, Phalerieae, Daphneae, Gnidieae.

Daphneae is divided into five subtribes.

Subtribes: Wikstroemiinae (including Wikstroemia canescens and chamaejasme), Dendrostellerinae, Daphnopsinae (including Lagetta lintearia), Daphninae, Rhamnoneurinae.

Daphninae is divided into three subseries or ramus.

Subseries: Daphne, Erisolena (including Daphne involucrata), Edgeworthia (including Edgeworthia gardneri and Edgeworthia chrysantha).

Daphne is divided into three sections.

Sections: Daphnantes, Laureola, Mezereum (including Daphne mezereum).

Daphnantes is divided into six subsections.

Subsections: Daphnanthoides (including Daphne sureil, Daphne bholua, Daphne papyracea, Daphne retusa, Daphne tangutica), Alpinae (including Daphne giraldii), Pseudomezereum, Oleoides (including Daphne alpina), Collinae (including Daphne sericea), Cneorum.

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64 G. Grönbold, p.366.
65 W. Domke, pp.101-102.

The names of fibres which are underlined were mentioned beforehand in the different publications, which means they all belong to the same family of Thymelaeaceae. But some fibres of this family are also called by other names. I came across the following:
Stellera chamaejasme, mentioned by Koretsky, is the same fibre as Wikstroemia chamaejasme[66].
Daphne is also called "lokta" in many publications, which is its Nepalese name[67].
Wikstroemia canescens is also called Gampi[68] according to Harders-Steinhäuser and Collings & Milner, but Koretsky[69] calls Gampi with the name Wikstroemia diplomorpha.
Mitsumata is called Edgeworthia papyrifera according to Harders-Steinhäuser[70], Edgeworthia gardineri according to Collings & Milner[71], and Edgeworthia chrysantha according to Koretsky[72].
The next fibre family which was mentioned in the publications is the Family Moraceae. I will only mention two fibres out of this family:
Broussonetia papyrifera or Paper mulberry or Kodzu or Kozo[73].
Cannabis sativa or Hemp[74].
The other two fibres which were mentioned in the literature survey were Rag and Bamboo, which were not clearly defined. There are different types of Bamboo, and Rag could be either linen or cotton.

b. Treatment of the paper

Nebesky-Wojkowitz[75], who reports in detail about Tibetan paper production, quotes that diluted milk or starch was used for sizing and that often arsenic was added. Hoernle[76] also mentions the use of arsenic in China since the 4th century, to avoid the running of ink

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[66] id. p.45.
[67] D. Field, pp.16-17.
[68] Harders-Steinhäuser. Faseratlas. p.98 and Collings & Milner p.64.
[69] Koretsky, p.2.
[70] Harders-Steinhäuser. Faseratlas. p.98.
[71] Collings & Milner p.66.
[72] Koretsky, p.2.
[73] Harders-Steinhäuser. Faseratlas. p.90 and Collings & Milner p.70.
[74] Harders-Steinhäuser. Faseratlas. p.92 and Collings & Milner p.58.
[75] R. Nebesky-Wojkowitz. Schritwesen, Papierherstellung und Buchdruck bei den Tibetern.
[76] A.F. Hoernle. "The Weber Manuscript, Another Collection of Ancient Manuscripts from Central Asia."

and as an insect repellant. Cornely[77] names arsenic as an ingredient of Tibetan paper, too.

Chemical investigations and close observations were made by Meisezahl, Harders-Steinhäuser and Jayme[78], who found that the paper was made from different layers, which were not connected with each other with an adhesive but rather pressed together in humid conditions. All of the paper layers especially the outer ones, contained a substantial amount of rice starch. A second paper was investigated at the same time and was found to include starch too. It was also detected, that a yellowish-brown dye emerged after the paper was immersed in water. This is probably orpiment, which was used particularly in the East. It is the yellow sulphide of arsenic, As_2S_3, occurring naturally in small quantities in many places. Gettens and Stout[79] say, that some hundreds of tons of orpiment are exported annually from Shih-haung-Ch'ang in Yunnan province. Trier[80] points out, that Tibetan manuscripts were not treated in the same way as paper from Nepal, and are less likely to contain starch, but may have been dusted with chalk powder. He also gives the result of a chemical analysis from a Tibetan manuscript of the 19th century, which shows to have been treated with calcite, $CaCO_3$. Sandermann and Funke[81] carried out a chemical investigation and detected arsenic in the pasting layer of Tibetan paper. Meisezahl, Harders-Steinhäuser and Jayme[82] presented their results and concluded, that the paper was made impervious to ink with a light starch size, made from an impure form of starch in which the cell tissue is still detectable. An additional size was produced through the natural appearance of milk sap which is produced by the bast fibres of the mulberry.

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[77] B. Cornely. "Eine papiergeschichtliche Untersuchung über das Schönen und Färben des Papiers in der Masse." p.56.

[78] Meisezahl, Harders-Steinhäuser and Jayme. "Alttibetische Handschriften im Reiss-Museum, Mannheim". pp.15-18.

[79] Gettens and Stout, p.135.

[80] J. Trier, p.207.

[81] Sandermann and Funke, p.42.

[82] Meisezahl, Harders-Steinhäuser and Jayme. "Die Tibetischen Handschriften und Blockdrucke im Antwerpener Ethnographischen Museum." pp.519-520.

I should mention, that Harrer[83] and Grönbold[84] both report that thousands of loads of paper were imported yearly from Nepal and Bhutan into Tibet, and perhaps from China too.

c. The blue-black paper

Cornely[85] reports in details about the technique of dying paper blue, which the Arabs have practised since early times. A mixture of indigo, gallnut tincture, iron salts and particular plant extracts are supposed to give a black dye.

Sandermann[86] asked the Central State Library in Ulan Bator in the People's Republic of Mongolia for details of the manufacture for the black and blue Tibetan papers. In an elaborate letter he was instructed that the paper was painted with a mixture of liquid adhesive, stove soot, and head or spine marrow of a mutton, and then the surface was smoothed with a glass roller. The supplement of the head or spine marrow was supposed to counteract the brittleness of the adhesive. After chemical investigations Sandermann found, that the blue paper did not contain soot but indigo. The adhesive was split into its amino acids, and the analysis indicated clearly a protein adhesive, which means a hide glue. Furthermore arsenic was proved to be in the paper.

In 1970 Sandermann and Funke[87] published new results. They interviewed the Tibetan monk Geshey Pema Tsering, who described the manufacture of glue made from lean hides. After all hair was removed they were exposed to the blazing sun for at least one year. Then the hide was boiled for a short time and the first fatty stock was discarded. Afterwards it was heavily boiled until the pure glue was achieved. (Sankrityayana[88] gives a similar recipe.) A supplement of mutton brain, not eaten in Tibet, it seems was only added when there

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[83] H. Harrer, p.120.
[84] G. Grönbold, p.366.
[85] Cornely. "Eine papiergeschichtliche Untersuchung über das Schönen und Färben des Papiers in der Masse."
[86] W. Sandermann. "Alte Techniken der Papierherstellung in Südostasien und den Himalaya-Ländern." pp.33-34.
[87] Sandermann and Funke. "Chemische Untersuchung eines schwarzen Tibetischen Papiers." pp.41-43.
[88] R. Sankrityayana. "Technique in Tibetan Painting." p.33.

was a lack of hide glue, and was not as reported from an other source, a sort of softening agent. To avoid the brittleness, the ready painted paper had to be dried slowly between freshly cut grass, as if under humidification. When indigo was not available to dye the glue, soot from birch bark was used as a substitute.

In another publication Sandermann[89] reported that he analysed a black lacquered paper, and his results were as follows: protein glue, yak fat, soot, indigo, arsenic, tanning agent and iron.

Trier[90] cites P.H. Bajracharya saying that the black or blue colour of Tibetan paper is called Niladuto (indigo) and that it is much more poisonous than orpiment. Its toxity can be gauged by the fact that even very old manuscripts on this paper are never worm-eaten or damaged by mildew. Hofenk de Graaff[91] quotes, that both the Egytian "Papyrus Ebers" from 1550 BC and Vitrivius mention indigo as a medicine.

d. Ink

In his travel book Heirich Harrer[92] describes, that the Tibetan monks used instead of printer's ink a mixture of soot, which they made by burning yak-dung. Sankrityayana[93], who also lived in Tibet for several years, reports a dust prepared from the soot of pine wood in the province of Kong-vo to the south-east of Lhasa, and this, ground in cold water with glue, is made into tablets of different qualities of black ink. Mr. Gyurmi Dorje[94] told me that black ink is made from a soot extracted from a certain plant called Tsa Kunzang (rtsra kun-bzang), how this plant is called in English he could not tell me. Sandermann[95] refers again to the blue-black paper and his source in Ulan Bator, which mentions several inks were made from gold, silver, mother-of-pearl, pearls and corals. They

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89 W. Sandermann. Die Kulturgeschichte des Papiers. p.56.
90 J. Trier, p.92.
91 J.H. Hofenk de Graaff, p.8.
92 H. Harrer, pp.240-242.
93 R. Sankrityayana. "Technique in Tibetan Painting." p.33.
94 SOAS London
95 W. Sandermann. "Alte Techniken der Papierherstellung in Südostasien und den Himalaya-Ländern." pp.33-34.

were manufactured by crushing the materials with a pestle and mortar and suspending them in an adhesive solution. Sandermann and Funke[96] chemically detected a gold ink.

e. Pigments

Sankrityayana[97] gives a full describtion of colours which he found during his travels in Tibet in the 1930s:

"Nowadays commercial colours are not unknown even in Tibet, but the better painters still prepare their own colours according to the fine old art of colour-making. White chalk, for example, comes in lumps from a place called Ring-bum, in the province of Lhasa. Yellow ochre comes as a soft yellow earth from Yer-va, east of Lhasa. It is prepared by boiling in water for two hours with a little glue; for glue is added to nearly all colours, to give them fixity and brightness. The ground for gold-work is first painted with this colour, which heightens the effect of gold. Gold itself, as also silver, which latter, however, is rarely used, is bought from Nepalese in the form of small tablets. This gold is mixed, as usual, with glue and water. Both blue and green in various shades are derived from mineral rocks found at Ni-mo, near Lhasa. The dust is ground in a mortar, cold water and glue are added, and the mixture is allowed to settle in a basin for fifteen minutes. The process is repeated, allowing different periods for settling, with the result that four different shades of blue and three shades of green are obtained. Then there is a rock-yellow procured from Kham province in eastern Tibet, and various red, such as oxide of mercury and vermillion, obtained either from India or China.
Indigo, derived from the indigo plant, of course, comes from India. It requires grinding from fifteen to twenty hours, with occasional sprinkling of water. There is also something called utpala water. In parts of Phembo district north of Lhasa, on shady hillsides, grows a flower known in Tibet as the utpala flower. The petals of this flower, mixed in the proportion of one to ten with the leaves of the shun tree which grows in Dukpa-land, or Bhutan, and boiled for a short time in water, produce a yellowish colour. Lac, an animal product, derived from the lac insect, is sent to Tibet from India and Bhutan. It is carefully cleaned, boiling water is poured over it, and a little alum and leaves of shun are added. The mixture is filtered and slowly boiled until it becomes quite thick. It

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[96] Sandermann and Funke, p.41.

[97] R. Sankrityayana. "Technique in Tibetan Painting." p.33.

is then made into small pills for use in the preparation of various lacquer colours.
There are, in addition to these pure colours, others obtained by mixing two or three colours together. A yellowish white, made from nine fourteenths parts chalk, three fourteenths parts rock-yellow and one seventh part vermilion. Pink-red, consisting of one half vermilion, three eights rock-yellow and one eighth chalk. Again, a yellowish red, prepared from vermilion, red oxide of mercury and chalk. The same three ingredients, however in a different proportion, give vermilion red. Bluish green and greenish white, and blue combined with utpala water. There is, too, lac-white, made from three fifths chalk and two fifths white lac."

V.R. Mehra[98] analysed a number of Tibetan thang-kas and reported the following additional pigments,

Green	Malachite, a green herb, emerald green (copper aceto-asenite) and Scheele's green (copper hydro-arsenite);
Red	Madder;
Black	Bone black, carbon black and bitumen

Bruce-Gardner[99] mentioned in his article on the conservation of Himalayan scroll paintings still some more pigments,

White	Kaolin
Red	Cinnabar, iron oxide
Orange	Minium
Yellow	Orpiment
Green	Green earth
Blue	Azurite

6.2. Paper analysis

The ten different items which I obtained for conservation and research could be divided into 29 different types of paper from their appearance and dimensions.
All paper tests were carried out after brushing the paper and prior to any other treatments.

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[98] V.R. Mehra, p.213.
[99] R. Bruce-Gardner, p.4.

a. pH Tests

The pH test was carried out with a Corning pH-meter model 7, a surface electrode Cat.No. 476 551 from Corning and distilled water. The pH-meter was calibrated before its use. The pH was taken four times on each paper in random places for a fixed time of 2 minutes.

b. Counting paper layers

The counting of paper layers from the different types of folios was carried out at the corners of the paper, which were usually split.

c. Caliper

The paper thickness was taken with a Messmer micrometer. Approximately 15 readings were taken, and the thinnest and thickest results are given.

d. Spot tests

The spot tests were carried out on minute samples on a watchglas. For every test only one sample was used, as the tests were destructive to the material.

Lignin

Reagent (Tappi T401)[100]

Phloroglucinol (1g) is dissolved in a mixture of methanol (50 cm^3), concentrated hydrochloric acid (50 cm^3) and water (50 cm^3). (Camberwell modification. IMS is substituted for the methanol.)

Method

One drop of reagent is added to the paper sample. A bright red or magenta colour indicates the presence of lignin.

Health and Safety

The reagent should be prepared in a fume hood. While carrying out the test a fume hood is not necessary as only small quantities of the reagent are used.

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[100] B.L. Browning, p.72-73.

Papermakers Alum

Reagent

Aluminon solution (1 g / 1 liter water)[101].

Method

One drop is applied to the paper sample and is allowed to dry briefly. A faint pink colour is obtained if alum is absent; in the presence of aluminum ions a deep pink is observed.

Health and Safety

There is no need for special health and safety measurements.

Starch

Reagent

Iodine (5 g) is dissolved in a solution of potassium iodide (7.5 g) in water (10 ml). The solution is diluted to 1 liter.[102]

Method

One drop is applied to the paper sample. A blue colour indicates the presence of starch.

Health and Safety

The reagent should be prepared in a fume hood. There is no need for special health and safety measurements while carrying out the test.

Rosin

Method (Raspail Test)

One drop of a nearly saturated solution of sugar (sucrose) is applied to the paper sample. After about 5 seconds the excess solution is removed by blotting with filter paper, and concentrated sulfuric acid (1 drop) is added. The development of raspberry-red colouration after a few seconds indicates the presence of rosin size[103].

Health and Safety

As only small quantities of the reagent are used a fume hood is not necessary.

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[101] id. p.318.

[102] id. p.93.

[103] id. p.81.

e. Arsenic Test

Method

The paper sample is mixed with 1 or 2 drops of ammonia, 1 of 10% hydrogen peroxide, and 1 of 10% magnesium chloride solution. The mixture is evaporated slowly and then strongly ignited. The arsenic is thus converted into heat-resistant $Mg_2As_2O_7$; the mercury salts are volatilized. The residue is mixed with 1 or 2 drops of a concentrated stannous chloride solution in 35% hydrochloric acid and warmed gently, until the solution evaporates. The residue is burned in a furnace at 925° C for 15 minutes. The formation of a brown-black precipitate or coloration indicates arsenic[104].

Health and Safety

Preparing the test solutions and the test porcedure have to be carried out in a fume hood, because some of the ingredients are irritant, corrosive or highly poisonous. A white coat, goggles and gloves have to be worn. The test solutions are to be prepared very slowly as they are highly reactive.

f. Fibre analysis

The fibre analysis was carried out with a compound microscope Nikon UFX-II with a magnification of 100 or 200 diameter and a polarising filter. Graff "C" stain was used for colour indication. The fibres were identified on the basis of the book "Faseratlas" by Dr. Marianne Harders-Steinhäuser and her published articles with R.O. Meisezahl, and the article "The identification of Oriental paper-making fibres." by Thomas Collings and Derek Milner. For every paper only one sample was used for analysis, as the sample taking is destructive to the material. Photo documentation was carried out with photomicrographic equipment Nikon FX-35A camera, Nikon UFX-II shutter equipment and colour film Kodak Gold II 100.

Constituents of Reagents

1. Aluminium chloride solution: Dissolve about 40 g of aluminium chloride hexahydrate ($AlCl_3 6H_2O$) in 100 ml of water.

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[104] Feigl and Anger, p.113.

2. Calcium chloride solution: Dissolve about 100 g of calcium ($CaCl_2$) in 150 ml of water.

3. Zinc chloride solution: Add about 100 g of dry zinc chloride ($ZnCl_2$) to about 50 ml of warm water until an undissolved residue remains. Allow to cool to room temperature and check that some zinc chloride crystallizes.

4. Iodine solution: Mix 0,90 g of potassium iodide (Kl) and 0,65 g of iodine (I_2). Add 50 ml of water dropwise to the mixture by means of a pipette, with constant stirring. If some iodine remains undissolved - probably because the water was added too rapidly - discard the solution.

Graff "C" stain[105]

Mix: 20 ml of aluminium chloride solution, 10 ml of calcium chloride solution, 10 ml of zinc chloride solution and 12,5 ml of iodine solution.

Pipette required volumes of solutions (1), (2) and (3) into a measuring cylinder and mix. Add the required volume of stock solution (4), mix again and place in the dark. After 12 h to 24 h, when any precipitate formed has settled, decant the clear solution into a brown dropper bottle, and add a flake of iodine. Keep the stain in the dark when not used. Make fresh stain about every two or three months.

Method

Two or three drops of the Graff "C" stain is applied on the fibre slide, placed under the microscope and examined. The fibres are identified on the basis of the colours developed by the Graff "C" stain.

Health and Safety

Some of the components used in preparing this stain are toxic. The stain should be prepared and handled in a fume hood wearing protective cloth, goggles and gloves.

The Graff "C" stain was prefered to Herzberg stain, since the former is more reliable and has a longer shelf-life[106].

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[105] ISO 9184-4:1990(E) relating to BS 7463 Part 4

[106] According to Dr. Chris Wilkins, UMIST, Manchester.

g. Watermarks, Tone and Surface of the Paper

These investigations are purely subjective observations which I carried out on a light table.

Note

I wanted to carry out a gelatine test, but the size of the sample needed (4 mm^2) was too large to be removed fromt the artefacts.

Library Number	pH Test	Layers	Caliper	Lignin	Alum	Starch	Rosin	Arsenic	Fibre Analysis	Watermark	Tone	Surface
H.M. NN1697	6.4 / 6.7 / 6.3 / 6.4	1	0.12-0.18 mm	negative	negative	negative	negative	positive	Thymelaeaceae	wove / imprint of cotton	white	coarse
H.M.183.90	5.6 / 5.5 / 5.4 / 5.5	1	0.07-0.11 mm	negative	negative	positive	negative	negative	Paper mulberry	laid	brown	polished
H.M. 1696	5.2 / 5.2 / 5.7 / 6.0	1	0.11-0.18 mm	negative	negative	positive	negative	negative	Hemp / Thymelaeaceae	wove	white	coarse
H.M. 6.12.65/65	6.5 / 6.4 / 6.3 / 6.5	1	0.11-0.48 mm	positive	positive	positive	negative	positive	Thymealaeaceae	wove	white	coarse
R.A.S. 5 pp.1-6	5.8 / 6.9 / 6.2 / 7.0	6	0.35-0.51 mm	negative	negative	negative	negative	positive	Chinagras / Paper mulberry	wove	pale brown	smooth
R.A.S. 5 pp.7-17	7.0 / 7.9 / 7.9 / 6.8	3	0.31-0149 mm	negative	positive	positive	negative	negative	Thymelaeaceae	wove	pale brown	coarse
R.A.S. 5 pp.18-26	6.6 / 7.0 / 6.6 / 6.3	4	0.32-0.78 mm	negative	negative	positive	negative	negative	Cotton / Thymelaeaceae	wove	pale brown	coarse
R.A.S. 5 pp.27-29	6.6 / 6.6 / 6.7 / 6.7	4	0.21-0.37 mm	negative	positive	positive	negative	positive	Thymelaeaceae	wove	pale brown	smooth
R.A.S. 5 pp.30-37	6.5 / 6.1 / 6.7 / 6.6	3	0.18-0.60 mm	negative	negative	positive	negative	negative	Hemp / Paper mulberry	wove	pale brown	smooth
R.A.S. 5 pp.38-39	5.4 / 6.3 / 6.4 / 5.0	2	0.30-0.64 mm	negative	positive	negative	negative	positive	Thymelaeaceae	wove	pale brown	coarse
R.A.S. 5 p. 40	6.7 / 6.0 / 6.7 / 6.6	6	0.49-0.68 mm	negative	negative	positive	negative	positive	Paper mulberry / Thymelaeaceae	wove	pale brown	coarse
R.A.S. 5 p. 41	7.2 / 6.5 / 5.7 / 5.9	2	0.26-0.53 mm	negative	positive	negative	negative	negative	Thymelaeaceae	wove	pale brown/yellow	smooth
R.A.S. 5 p. 42	6.0 / 6.7 / 7.3 / 6.6	7	1.17-1.78 mm	negative	negative	negative	negative	negative	Thymelaeaceae	wove	pale br./yel. & dark blue	coarse & polished
R.A.S. 5 pp.43-44	6.2 / 6.4 / 6.2 / 7.0	4	0.12-0.27 mm	negative	negative	negative	negative	positive	Thymelaeaceae	wove	pale brown/yellow	coarse
R.A.S. 5 pp.45-46	6.3 / 6.2 / 6.6 / 5.6	6	0.34-0.59 mm	negative	negative	positive	negative	negative	Paper mulberry / Thymelaeaceae	wove	pale brown/yellow	coarse
R.A.S. 5 p. 47	6.1 / 6.4 / 5.1 / 5.6	2	0.16-0.24 mm	negative	negative	positive	negative	positive	Thymelaeaceae	wove	pale brown/yellow	coarse
R.A.S. 5 p. 48	6.4 / 6.2 / 5.9 / 6.6	3	0.18-0.84 mm	negative	negative	negative	negative	positive	Thymelaeaceae	wove	pale brown/yellow	coarse
R.A.S. 5 pp.49-56	6.7 / 6.1 / 6.4 / 6.2	2	0.21-0.48 mm	negative	negative	negative	negative	positive	Cotton / Thymelaeaceae	wove	pale brown/yellow	coarse
R.A.S. 5 p. 57	5.6 / 6.3 / 5.4 / 5.8	2	0.18-0.43 mm	negative	negative	positive	negative	positive	Thymelaeaceae	wove	pale yellow	coarse
R.A.S. 5 p. 58	5.5 / 5.8 / 5.4 / 5.4	8	0.47-0.86 mm	negative	negative	positive	negative	negative	Thymelaeaceae	wove	pale yellow	coarse
R.A.S. 7	5.3 / 6.2 / 6.2 / 5.9	1	0.13-0.56 mm	negative	negative	positive	negative	negative	Thymelaeaceae	wove	brown	coarse
R.A.S.12	5.6 / 5.4 / 5.3 / 5.5	1	0.12-0.41 mm	negative	negative	positive	negative	negative	Thymelaeaceae	wove / imprint of cotton	pale yellow	coarse
R.A.S.13 pp.1-13	3.8 / 4.0 / 4.6 / 4.1	1	0.12-0.22 mm	negative	negative	positive	negative	positive	Thymelaeaceae	wove	brown	coarse
R.A.S.13pp.14,15,18	5.3 / 4.4 / 4.8 / 4.9	1	0.11-0.29 mm	positive	negative	negative	negative	positive	Thymelaeaceae	wove	grey	smooth
R.A.S.13 pp.16-17	4.7 / 3.9 / 5.5 / 4.3	2	0.11-0.35 mm	positive	negative	negative	negative	positive	Thymelaeaceae	wove	pale yellow/brown	smooth
R.A.S.13 p. 19	4.7 / 5.5 / 5.7 / 5.5	1	0.11-0.32 mm	negative	positive	positive	negative	positive	Thymelaeaceae	wove	brown	smooth
R.A.S.13 pp.20-21	4.5 / 5.4 / 5.9 / 6.0	1	0.12-0.62 mm	negative	positive	negative	negative	positive	Paper mulberry / Thymelaeaceae	wove	pale brown	coarse
W.I. 11b	5.4 / 5.9 / 5.1 / 5.6	3	0.18-0.29 mm	negative	negative	positive	negative	positive	Paper mulberry / Thymelaeaceae	wove	dark blue	polished
W.I. 38	5.8 / 6.0 / 6.9 / 7.0	1	0.09-0.22 mm	negative	negative	positive	negative	positive	Thymelaeaceae	wove/ imprint of bamboo	pale yellow	smooth

6.3. Results

The pH value of the paper ranged between pH 3.8 and 7.9 which can be considered as freak values. The centre of value lies between pH 5.4 and 7.0 and the peak value is pH 6.6 which appeared frequently.
Most of the investigated paper types are single-layered folios, being eleven of the 29 different paper types. Seven are two-layered papers, three are three or four-layered folios and one seven or eight-layered folio.
The paper thickness or caliper ranged between 0,07-0,11 mm and 1,17-1,78 mm. The average thickness of the paper is 0,36 mm. It has to be taken into account, that many of the measured papers are multi-layered.
The spot tests and the arsenic test gave following results, from 29 tested papers. The lignin test had three positive reactions, papermakers alum seven positive reactions, starch 19 positive reactions, rosin had no positive reaction and arsenic had 18 positive reactions.
The fibre analysis can be concluded as following. 19 papers are made from pure Thymelaeaceae, one from Thymelaeaceae and Hemp, two from Thymelaeaceae and Cotton, four from Thymelaeaceae and Paper mulberry, one from pure Paper mulberry, one from Paper mulberry and Chinagras, and one from Paper mulberry and Hemp.
Please see the photo documentation of the fibre analysis in Appendix III.
None of the papers had a water mark. 25 from 29 papers are wove, two are wove with an imprint of the cotton mould, one is wove with an imprint of a bamboo mould and one is a laid paper. Eight papers have a pale yellow/brown tone, eight have a pale brown, five a pale yellow, four a brown, three a white, one a grey tone and two are dark blue. The surface of the papers were as following, 19 are coarse, eight are smooth and three are polished.
Please see for the complete results also the table on the page before and Appendix II (Conservation Documentation).

6.4.Discussion

The centre of pH value between 5.4 and 7.0 seemed to be quite low considering the papers were mainly made from pure bast fibres and there were only three positive indications of lignin content. The paper with the lowest pH between 3.8 and 4.1 was very brittle and had dark stain, and it seemed as if the paper had been in a fire. The peak value of pH 6.6 is a satisfactory result, considering the paper can not be given a wet treatment.

The paper layers are sometimes difficult to distinguish, because they are very thin and firmly pressed together. The single-layered papers which were found, are either papers from prayer-wheels, from the bound book or two large drawings which are folded into the pothi books which need to have flexibility, or are printed folios from the pothi books. The folios of the pothi books which are manuscripts are all made from several layers of paper.

The lignin found in three paper samples made entirely from the fibre Thymeleaeceae, was only a trace. This fibre is not supposed to be as lignin free as cotton, therefore this result seems to be very good.

The alum which was found in the papers is not an additive to rosin size, because all rosin tests were negative, but can be either an indication that soda ash or potash was used in the prepapration of the fibres before the pulp was beaten (see 2.1.b. Forms of Writing and Printing Support), or for alum which was used as a substrate for dye colours.

The positve results of the starch tests was not astonishing, as the papers had a shiny appearance to them, which indicated a treatment with starch. Also during the fibre analysis starch particles were often obvious. It is interesting that ten of 29 starch tests were negative, which might result from the fact, that the starch powder was sprinkled on the paper surface and then moistened with water[107] or brushed on in solution. As only one minute sample per paper was taken and used for this spot test, the edges from where the samples came might have been missed by the sprinkling of the starch powder.

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[107] Trier, p.93.

Rosin size has been used with aluminium sulphate as an internal paper size since 1805 in western countries. As in Tibet the original paper making method as invented by Ts'ai-lun is still used, the completely negative test result for rosin was no surprise.

The arsenic test was carried out on the papers because the literature survey indicated its contents as an additive against insects. However eleven tests from 29 gave a negative result, and the test is supposed to be very sensitive. According to Trier[108] the treatment of paper with arsenic has been used in China from the 5th century, but did not become widespread until about the 16th to 17th century in Nepal, and is still used today. It is unknown when this treatment became used generally in Tibet and is therefore an inaccurate method for dating papers. It is interesting to state that all the papers which did not contain arsenic had waterstains and mould growth, or had been attacked by vermin. This might suggest that the arsenic was washed out by the water, and that arsenic is normally a protection against mould growth as well.

The paper analysis confirmed the investigations quoted in the literature survey. I wanted to distinguish the Thymelaeaceae fibres with Daphne bholua, Edgeworthia gardneri and Wikstroemia canescens, which I did while I was analysising the paper fibres. Normally the fibre differentiation is made by the length of the fibre, appearance of cell walls, fibre ends, parenchymal cells and colour indication of the stain. As these subtribes and subseries of the Thymelaeaceae vary so much, and reading again the characteristics of these bast fibres by Trier[109] I had to admit that it is very difficult to make a distinction with a clear conscience. Also I do not think it is important as a conservator to distinguish the different Thymelaeaceae fibres, but just to know that it is a Thymelaeaceae fibre. The contents of Paper mulberry, Chinagras, cotton or hemp is an indication that the paper comes from an area close to a border country or from a border country itself.

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[108] ibid.

[109] id. p.189-195.

The papers were expected to be wove, because Tibetan paper is manufactured on a cotton mould. Those two which have an imprint of the cotton are presumably made on a mould whose cotton was woven more coarsely. One paper appeared laid, but the laid lines are rather wide and irregular, and sometimes disappear. This paper is made on a bamboo mould. Fortunately the title of the book to which the paper belongs gave the place of origin in Tibet. I looked Phari up in a travel book[110] and found that it is located right beside the Bhutanese border. Therefore the paper was either made in Bhutan or the bamboo was bought in Bhutan and then carried to Tibet. There is one laid paper with very fine lines, an even fibre distribution and which also seemed to be dyed, this is certainly not a Tibetan paper. The papers were mainly of pale yellow or brown tones, which derived from the colouration of the fibres or ingrained dirt, because they were not dyed or bleached. All the papers contain impurities of bud and leaf tissue clearly visible and show a cloudy fibre distribution against the light. They do not have a surface coating other then starch, and the amount of this makes them appear either coarse or smooth. The colour of the blue papers was obviously brushed on the surface, which was clearly visible on item R.A.S. 5 p.42 of which the edges were still white. The centre of the folios where the text is written, have a glossy, polished appearance.

6.5. Pigment Analysis

a. Laser Raman Spectroscopy

The method of identifying pigments with a laser raman microscope is non-destructive to the material in question. Therefore it is a most apropriate method from a conservation point of view. The specctroscopy was kindly carried out by Dr. Robert Withnall, Dept. of Chemistry, at the University College London.

The laser raman microscope can only identify inorganic pigments by comparison with already identified pigments in the attached computer software.

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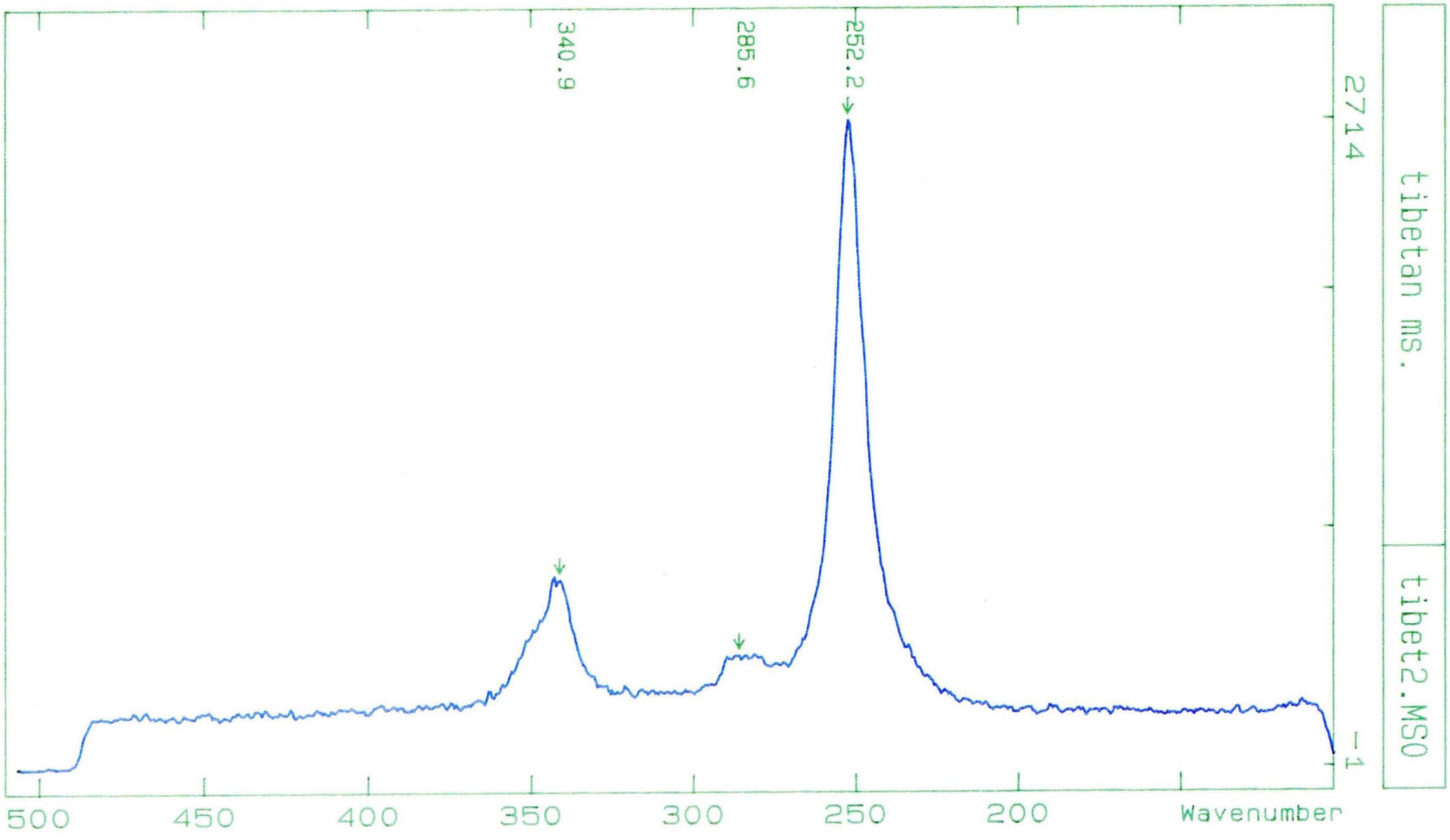
[110] Buckley and Strauss, p.162.

APPLICATIONS LAB
D.I.L.O.R.
Version 2.00 IBM

DILOR
XY

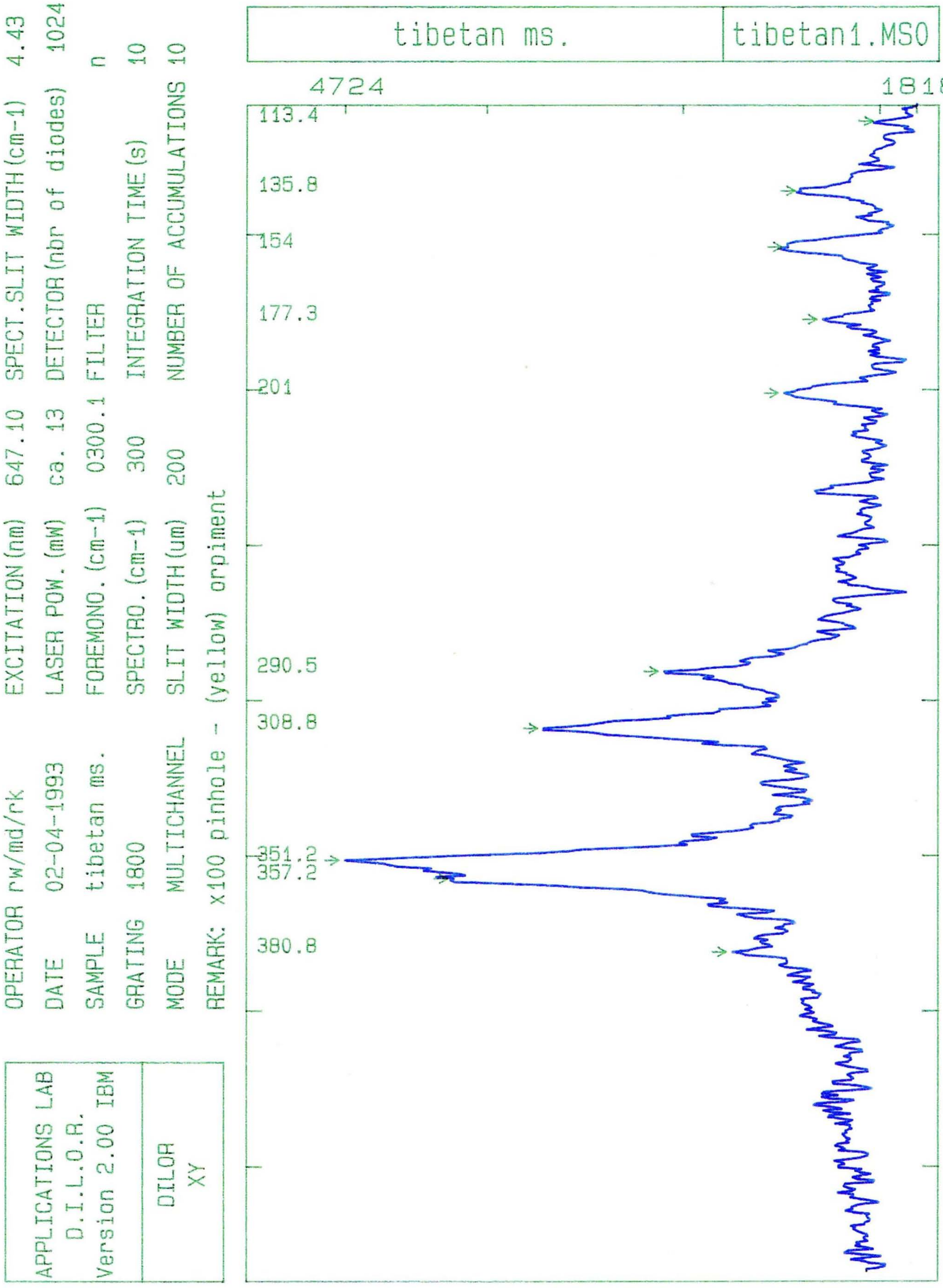
OPERATOR	rw/md/rk	EXCITATION (nm)	647.10	SPECT.SLIT WIDTH (cm-1)	4.43
DATE	02-04-1993	LASER POW. (mW)	ca. 13	DETECTOR (nbr of diodes)	1024
SAMPLE	tibetan ms.	FOREMONO. (cm-1)	0300.0	FILTER	
GRATING	1800	SPECTRO. (cm-1)	300.1	INTEGRATION TIME (s)	1
MODE	MULTICHANNEL	SLIT WIDTH (um)	200	NUMBER OF ACCUMULATIONS	50

REMARK: red - vermilion



tibetan ms.

tibet2.MS0


APPLICATIONS LAB
D.I.L.O.R.
Version 2.00 IBM
DILOR
XY
OPERATOR rw/md/rk
DATE 02-04-1993
SAMPLE tibetan ms.
GRATING 1800
MODE MULTICHANNEL
REMARK: x100 pinhole - (yellow) orpiment
EXCITATION(nm) 647.10
LASER POW.(mW) ca. 13
FOREMONO.(cm-1) 0300.1
SPECTRO.(cm-1) 300
SLIT WIDTH(um) 200
SPECT.SLIT WIDTH(cm-1) 4.43
DETECTOR(nbr of diodes) 1024
FILTER n
INTEGRATION TIME(s) 10
NUMBER OF ACCUMULATIONS 10
tibetan ms.
tibetan1.MSO
4724
1818
113.4
135.8
154
177.3
201
290.5
308.8
351
357.2
380.8
Wavenumber
250
200
300
350
400
450

b. Indigo test

Method

Warm a sample in alkaline solution of sodium dithionite (2 % w/v). A pale yellow solution of leuco indigo will be formed. Shake this reduced solution with a small amount of ethyl acetate. Allow the layers to separate. The ethyl acetate layer on top will slowly turn blue as the leuco indigo oxidises.

Health and Safety

Carrying out the test in a fume hood is not necessary as only small quantities of the reagent are used. However gloves and goggles should be worn.

6.6. Results

The laser raman microscope gave the following result, the blue paper of item No. W.I. Tibetan 11b could not be identified due to flourescence. From item W.I. Tibetan 38, which has different coloured strokes in water colour above the writing, the following were identified, one of the red is vermillion, but there are other organic ones, the yellow is orpiment and the brown is organic also. The indigo test was positive on the blue paper of item W.I. Tibetan 11b.

6.7. Discussion

The laser raman spectroscopy is a very costly and time consuming method of identification. The results which I presented took two full days. The focusing of the laser (for every colour another laser is used) took hours and even when the method is not supposed to be destructive to the material the paper had to be clamped into the microscope. From this I gained two positive identifications and three indications that the pigments were organic. Personally I learned a lot and it was certainly very interesting to see this method applied. I am very grateful to Dr. Robert Withnall and the Dept. of Chemistry at the University College London.

The result of the indigo test was no great surprise, as the literature survey already indicated this result, and I expected an organic pigment according to the laser raman microscopy.
I did not carry out any further pigment analysis, because I was running out of time, and as I already mentioned it was not my major concern.
The black ink which was not identified is most probably a type of soot. It is difficult to distinguish them in their chemical characterization according to John Winter[111].

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111 J. Winter, p.52.

7. Authenticity of prayer scrolls

The Assistant Keeper in the Ethnographic Collection of the Horniman Museum was in doubt about the authenticity and age of the four paper scrolls of prayer-wheels, which are part of this research. (See chapter 3. "Description of material" or Appendix II.) He asked me to clarify these questions.

In chapter "Prayer-wheels" (2.2.) I have already quoted Zwalf, who claims that blockprinted, tightly rolled texts or repeated invocations are the usual contents of prayer-wheels.

From four paper scrolls two are blockprinted and two are manuscripts. One of the printed prayer scrolls is a folded page of a pothi book and one of the manuscripts is a folded page of a bound book, the other two are rolled scrolls.

Because I do not read Tibetan I again asked Mr. Gyurmi Dorje and Mr. Tudeng Nima from the School of African and Oriental Studies in London, who were extremely helpful, to translate the text of the paper scrolls and to give me their opinion of authenticity. With the result of this meeting and of the paper analysis I came to the following conclusions.

The printed and rolled paper scroll No. NN 1697 LAB.8097 has inscriptions of different mantras "Manjushri, Avalokite's vara, Vajrapami, Amitayus, White Tara, Vijaya". They are aspirational prayers for good furtune, prosperity and good health. Mr. Dorje and Mr Nima pointed out that there seemed to be a lot missing. The paper analysis indicated that the paper is certainly a Tibetan one, because the fibre content is pure Themelaeaceae, the arsenic test was positive and the paper is wove with a cotton mould imprint. It can be concluded, that this is a fragment of an authentic prayer scroll.

Book folio No. 1983.90 LAB.8098, which was folded and rolled into scroll form and which had been placed inside a prayer-wheel is part

of a Sanskrit verse, a religious Buddhist song, which starts in the middle of verse 15 up to verse 21. According to Mr. Dorje and Mr. Nima this folio is not Tibetan, but it is most probably Nepalese, because it is written in Sanskrit and in the Deva Nagari style, and also the Nepalese use prayer-wheels adopted from Tibetan culture. The analysis of this paper shows that it is certainly not a Tibetan paper, because its fibre content is pure Paper mulberry, it has fine laid lines and a very even fibre distribution, the paper has a pale brown tint and the surface is polished. The paper is very thin and behaves more like an Arabic paper. If this paper is Nepalese it could be dated according to Trier[112] earlier than the 16th or 17th century, because no arsenic was found in the paper. Mr. Dorje and Mr. Nima also pointed out that this fragment seemed to them to be very old, but they did not say how old. In conclusion I can say, that this folio is an authentic Nepalese prayer scroll.

The paper scroll No. NN 1696 LAB.8099 is a manuscript written in blue ink. It is a Sutra, for the confession of sins and negativity. Mr. Nima pointed out that this blue ink is not normally used in Tibet and it is probably a chemical one, and that the text is incomplete. The head and tail of the paper scroll is very roughly cut, partially through the writing. This made Mr. Nima say, that a Tibetan would never cut through the "word". Therefore he came to the conclusion that this scroll is not an authentic prayer scroll. The paper analysis gave following results, the fibre content is Thymelaeaceae with Hemp, the paper is wove and whitish, and the arsenic test was negative.

Pothi book folio No. 6.12.65/65 LAB.8100, which was folded and rolled into scroll form and which had been placed inside a prayer-wheel. It is a teaching, clarifying the stage between death and rebirth, from the "Book of the Death". According to Mr. Dorje and Mr. Nima, this does not belong in a prayer wheel. The paper is a Tibetan one, which is indicated by the paper analysis. The fibre

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[112] Trier, p.93.

contents is pure Thymelaeaceae, the paper is wove and whitish and the arsenic test was positive. Therefore the folio is not a prayer scroll, but a fragment of a Tibetan pothi book.

8. Conservation

8.1. Outline of conservation problems typical to Tibetan books and paper

The papers were generaly covered in heavy black dust and had black greasy edges from fingerprints. The dust is probably yak soot from heating and cooking fires, and the grease derived from the favorite Tibetan drink, buttertea, and the butterlamps.

The surface of the paper is very soft and many have a coarse structure with fibres which can be easily pulled out. Many of the actual paper sheets are made of several layers of paper pressed together in humid conditions without using adhesive. Many of these layers are split at the edges.

Because the paper is not coated, the glue of library labels migrates easily into the following folios, which makes them stick together.

Usualy the paper has arsenic as an additive in the pulp to protect them against insect attack. Most of the inks and pigments are soluble in water and IMS. These two reasons and the danger of splitting the paper into its different layers makes it impossible to wash the paper. Even if the paper is very dirty, single-layered and the ink is not fugitive, it would certainly be highly unethical to wash these papers and to remove the arsenic, which has protected them against insects until now. This statement can be verified by the fact that waterstains can be found on some of the papers. Most of them have resulting mould stains or traces of insect attack, which are due to the starch sizing.

The blue paper has its problems in a European environment and it might not have had the same effect in Tibets' cold and dry climate. Traditionally indigo was applied to paper in a mixture of hide glue. To avoid the brittleness, the ready painted paper was dried slowly between freshly cut grass, as if under humidification. In Europe with the changes of temperature and the fluctuation of humidity, the paper will become brittle. The paper could have a wash treatment, as indigo is insoluble in water, to stablelise the paper. The problems

may be in what happens to the hide glue in which the indigo is dispersed, and also what happens to the paper, which is made from several layers. This treatment may completly change the appearance of the paper.

Tibetan books with cloth covers do not have cardboard boards. Therefore badly damaged cloth covers become floppy and easily expose the inside papers to deterioration. They also do not have endpapers, because the cloth cover is pasted on the first page, therefore the first and the last gatherings are heavily creased and have missing areas. The bound book is made from very thin single-layered paper for flexibility, and this results in numerous tears at the edges and in the folds. The sewing, carried out with two coarse hemp threads, is exposed without protection, resulting in the wearing of the threads and subsequently loss of pages.

The conservation of original wrappers and boards of pothi books if they are still with the book, would be kept to a minimum by a conservator of library and archive materials. When they are missing, the paper is exposed with no protection and therefore the folios are heavily covered in dirt. Usually a ribbon is then tied around the text block which causes destruction of the outer folios, eg. tears creases and fraying. If the boards are still with the text block, the paper edges are damaged especially at the right and left hand sides as they slip out of the book covers, which results in tears and missing areas.

In elaborate pothi book editions the title page is protected with a curtain made from silk or brocade, which is attatched to the page with a paper mount. The paper mount and the silk are often torn or have missing areas caused by slipping or loss of the book board. The verso of this title page should normaly be turned inside to protect the curtain and mount, at least that was what I found in books where the page was still intact.

If a pothi book has large drawings as part of the text block, then they are folded into the oblong shape of the book format. The left and right hand sides have missing areas in the same way as the

folios and also at the folds because they are exposed at the head and tail of the book.

More often than not the cotton or silk wrappers and the wooden boards are lost, and their replacement is a problem. In this case there is no indication as to which materials were originally used, because there are no remaining attachments, and one has to decide on an appropriate replacement material. Wood has the problem of acid migration into the paper, and new wood will bend or split with time. The most desirable wood is that of the Nim tree with its insect repellant properties, but it is almost impossible to buy in Europe, as India restricts its export. The reason for this may be that the tree is considered sacred by the Hindus, despite the fact that the tree grows everywhere in India and is far from rare. A wood with similar properties is Sandalwood, which also grows in India. Whatever wood is chosen for replacement, it should be seasoned and covered with acid-free paper as a buffer against the text block. Selecting a new protective wrapper makes the choice between cotton and silk an easy one, when one takes into account the overwhelming properties of silk. There is still the problem as to which colour of silk should be used. This question could only be answered by a Tibetan scholar regarding each book individually according to its affiliated sect. It might be a safe method to use undyed silk, indicating that the wrapper had been replaced, which would be more ethically acceptable from a conservation point of view. The last problem is the question of which way the wrapper and the boards were placed on the text block. This might have been a method specific to an area in Tibet or a particular monastry. One choice is to wrap the text block in the silk, place the boards on top of this and secure together with a silk or leather cord. This would provide better protection for the paper against acid migration from the wood. On the other hand, the wooden boards could be easily lost when kept outside, and the handling of the book block would be more disturbing. If the wooden boards are placed direcly on the book block, they would then also be protected with the silk, and the unwrapping of the actual text would then be conducted in a more

sympathetic manner. It would make more sense to put the boards straight on the text block, as their weight would keep the paper flat.

The paper scrolls mainly deteriorate because the lid of the prayer-wheel has been lost, which results in the fraying of the paper edges and dirt finds its way into the paper scrolls. If the prayer-wheel is made from metal the rust will spread into the paper. Very often the prayer scroll has lost its container and is exposed to damage due to bad handling. The paper scroll is made from several long pieces of paper which are connected with an adhesive. Very often parts of the scroll are missing.

An interesting problem is, and this question was asked by several people, how is one going to place a complete paper scroll, which is very tightly rolled back into its prayer-wheel? After listing the above conservation problems I came to the conclusion, that probably this paper would not need any conservation treatment because it is so tightly rolled and just fits into the prayer-wheel, that it can not slip out or dust can not penetrate between the pages. In the case of the scroll being forced out of the prayer-wheel it will be a similar problem to put the scroll back into its container, as for a bookbinder a text block back into its original binding.

8.2. Paper soil

Soil is a foreign matter which is not an original part of the object, or is a product of alteration of the original material of the object. Removing soil from the object is rarely possible without also removing some of the object. These difficulties derive from natural or corrosion-induced porosity of the surface of paper and the extreme fineness of the soil as it starts to coat the object.

a. What is paper soil

Paper soil is a mixture of fragments of human skin, textile fibres, carbon particles, grease from unburned hydrocarbon fuels, from cooking and from the skin of people and animals. There are inks,

rust from staples and paper clips, adhesive residues and often salts, for example, sodium chloride (carried in from sea spray or on skin fragments), and silica crystals. In this chemical mixture are the spores of countless moulds, fungi and micro-organisms which live off the organic material in the soil.

Paper soil arising from air pollution is associated with towns and industry and is almost entirely caused by the burning of fuels. There is a lot of sooty and tarry material in them and usually acid from absorbed sulphur dioxide. They contain traces of metals such as iron which can catalyse deterioration.

The soil particles vary hugely in size. If they are larger than 15 or 20 microns they settle near their source of origin. Particles smaller than this remain suspended until trapped on a surface. The lower end of the scale can be taken as 0.01 micron, a hundreth of a micron, and smaller than the wavelength of visible light (½ micron). Apart from urban pollution, natural particles produced by forest and plant cover, including volatile material given off by them and polymerised by sunlight, may contribute up to 15 $\mu g/m^3$, but usually much less.

b. How does soil stick to the fibres

There is a weak attractive force acting between all atoms and molecules continually. This is called "Van der Waals forces". Soil is held to the surface of objects by these forces. The problems of cleaning can be looked at as comparisons of the strength of the adhesion of the dirt to the object and the cohesion of the molecules of the object to one another. Obviously dirt weakly stuck to a strong object is going to be easier to clean off without damaging the object, while soil firmly stuck to a weak object presents a greater problem.

c. Methods of removing paper soil

Dry cleaning devices might be used when the paper or media can not withstand aqueous treatment, or prior to aqueous or solvent treatments which could set unremoved particulate dirt. This can be

accomplished by brushing with a soft brush. Further cleaning will require the application of erasing compounds. This is a granulated eraser powder which is sprinkled over a surface. The gentle overall action of cleaning powder may not be sufficient to remove more resistant dirt. A wide variety of erasers can be used with a blotting action to lift particles that may smudge with rubbing. Fresh bread crumbs have also been used for cleaning paper.
The use of solvents in connection with paper is usualy to remove foreign matter which has penetrated into the texture of the paper. Like substances dissolve like. Organic solvents are used on organic dirt such as grease, glues, tar and mildew stains. Organic solvents in general are likely to be innocuous as far as any risk of dissolving the main structural materials, such as cellulose, is concerned. Solubility parameters and the hydrogen bonding capacity of the solvent and solute should be matched, and then the rate of evaporation of the solvent or mixture of solvents chosen for use.
Water cleaning is another treatment to remove paper soil, but it is not taken into consideration, because Tibetan paper can not be water washed as mentioned earlier.

d. Advantage and disadvantage of removing soil and the alternatives

The main reason for removing soil from the paper should be because the specific soil is destructive to the object. When dirt on the paper becomes moist from high humidity or flooding, it is carried further into and across the paper. There are also aesthetic considerations, because dust and dirt disfigure and obscure works.
Brushing is a gentle and effective way of cleaning surface dirt, but it may have an abrasive effect on soft paper, or when done with a hard brush. Brushing should be carried out in a fumehood as the smallest soil particles can penetrate into the breathing tracts and could cause a serious health hazard.
Erasing compounds are an effective way of removing surface dirt on a smooth and strong paper, but

> "since some of the substances found in cleaning powders are potentially harmful to paper, several brushings may be necessary to remove all visible traces of the powder."[113]

A soft, porous paper containing a minimal amount of size will trap particles of erasing powder, which are very fine. It may be impossible to brush away all the residue left by the erasing materials. Long-fibred Oriental papers can be very soft and absorbent by nature. Dry cleaning powders should not be used on these papers.

Brushing is clearly not an effective way for removing all of the particulate eraser material, and it may even enmesh the particles deeper into the paper fibre.

Erasers will cause fragmentation or tear on severly degraded, thin and flimsy paper types. It should only be used with extreme caution. Papers with a highly calendered, slick, hard or waxy surfaces are often heavily coated. Attempts at erasure can result in smudging of the dirt and inks, and a marring of surface gloss.

Pearlstein, Cabelli, King and Indictor[114] tested dry cleaning materials used for treatments of paper, which were the Magic Rub, Pink Pearl, and Kneaded Rubber erasers and the Opaline Pad. Their results were that all products tested using several dry cleaning procedures altered surface characteristics but not mechanical properties. Treatments using all eraser samples left detectable amounts of eraser material in the paper. Photomicrographs showed that attempts at complete removal of eraser crumbs were unsuccessful.

Dry cleaning with bread crumbs is an alternative to the overwhelming disadvantages of erasers. But most recipes for bread include oil or fat, which may be absorbed by the paper. Also, any residue of crumbs will support the growth of mould and may encourage attack by pests. There is still the possibility of preparing the bread by oneself without any oil or fat. But the raising agent may also have a longterm effect on the paper.

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[113] Cowan, J. p.5

[114] Pearlstein et al. p. 1-12.

Organic solvents are a good alternative as a dry cleaning method instead of a water wash. When the solubility parameter and hydrogen bonding capacity of the solvent and solute are correctly matched, it is an easy and safe way of soil removal. Inks and pigments have to be tested for solubility and colour change prior to treatment. Sizes and other additives might be washed away during treatment with organic solvents, and the texture of the paper will become softer and more porous. Many of the organic solvents are health hazards or are toxic and should be only used in fume hoods and with specially indicated protection measurements.

Before using any of the above treatments, one should clarify why one wants to clean the object and should some or all of the dirt remain. Paper soil can be part of the history of the object, and a completly cleaned paper can change its whole appearance. If the soil is doing any damage then the stability of the object should be taken into consideration before chosing a cleaning treatment safe both for the conservator and the object. If the soil particles are non-destructive and there is no safe treatment for it and the conservator, then the soil should be left on the paper.

8.3. Treatments

The paper of all items needed brushing because the black particles on the surface were so heavy that they immediately stuck to the fingers of the user or penetrated the breathing tracts. This was accomplished with a soft brush in a fume hood.

Further cleaning treatments were not considered as the remaining soil was not thought to be damaging to the objects, and any other cleaning treatments would have been unsafe. Erasing compounds or erasers would have introduced new particles into the paper and the cleaning action would have torn or disrupted it. Most of the pigments were soluble in water, and some in IMS or IMS / water. Organic solvent cleaning or water washing was considered as unsafe and highly unethical because it would have removed the starch size and the arsenic from the paper.

Arsenic is a protective agent for the paper in respect of its insect repellant quality. Even if the paper is very dirty, it would be unethical to wash it and to remove this additive which has protected it.
As the remaining soil particles are not thought to be destructive to the paper, they have to be considered as part of the history of the paper, and give the object its specific appearance.
One pothi book, the bound book and the four paper scrolls recieved further treatments. The paper of all these items were lightly spray relaxed with distilled water and then flatten out.
The paper of the pothi book No. R.A.S. 13 was then very briefly washed on wet blotter for a maximum of 5 minutes. This treatment was carried out, despite the fact that it might remove some of the arsenic contents, because the paper was very brittle and had dark stains which obscured the text. It seemed as if the first 13 folios had been in a fire. There were many water stains on all folios, a library label on the first page and self adhesive labels used as repairs on the two large drawings which are part of the book. This brief blotter washing improved the paper tremendously, the library label and the repairs were removed, the dark stain was considerably reduced and the paper was much less brittle. The improvement of the flexibility of the paper was observed in all papers which were spray relaxed with distilled water and then flattened. This improvement was not temporary but can still be detected. This was why brief blotter washing was chosen and also because of the improved appearance of the text.
The missing areas of all papers were repaired on both sides with a thin off white handmade Daphne[115] paper using rice starch adhesive 10% w/v. The repair paper was chosen as it was sympathetic to the original material and was not dyed, as the traditionally Tibetan paper was not. The repair was carried out from both sides to match the thickness of the original paper and to make the overlap of the repair paper as thin as possible. Rice starch was used in preferance to wheat starch because of its greater flexibility. The tears were

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[115] Family Thymelaeaceae.

repaired with a thin handmade Mulberry tissue from Thailand, and the two missing pages of the bound book were replaced in a single thickness with an 18th century Nepalese or Tibetan paper made from Mulberry and Daphne.

From the bound book No. W.I. Tibetan 38 the cotton cloth covers and joints could be removed with spray relaxing. The cotton cloth was washed on blotting paper on the suction table. Good result was achieved as the material could not shrink during the treatment. The cloth was also dried on the suction table.

A pure linen cloth was chosen for the backing of the cotton cover because the original cloth had a very coarse structure which resembled more linen then modern cotton material. Also the linen is more rigid, which will stablelize the whole binding. The edges of the linen had to be frayed, or the infolds would have been too thick after consolidation.

The remains of original threads in the book, were not reused, as they were too fragile. They will be returned to the owner with the conserved book. Instead new hemp pageing cord was used for the sewing.

The resewing of the pages was carried out using the original holes. This made the book look like a random paper collection, but the offset of the original color strokes had to match.

All pothi books which did not have wooden bards or wrappers were supplied with them. The chosen wood for the boards was seasoned walnut ready cut by the supplier. A carpenter bevelled the edges, as walnut is extremly hard. I gave them the finish and applied acid-free museum board with animal glue to the wood as a buffer. The wrappers were made in one thickness from undyed silk. As this silk is only available in a 1 metre width, pieces had to be attached to each other because the wrappers are supposed to be square.

Please see for the complete documentation of every item Appendix II.

No.30 Four pothi books with new wooden boards.

No.31 Four pothi books with new wooden boards and new wrappers.

9. Conclusion

Tibetan heritage has been endangered since the Chinese invasion of 1950. Before this Tibet was an independent country with closed borders to the outside world. The culture was influenced mainly by China, India and Nepal and dominated by religions of Buddhism, Bon and folk religion.

Writing support was either birchbark or paper which was printed with blockprint or written on with a bamboo pen. The book format is not the only shape in which prints or manuscripts appear, but also in scrolls which are placed in prayer-wheels, consecrated sculptures or charms.

There are two different book formats, which corespond perfectly with its contents. The heavy pothibook format or pothi book is used for religious texts and sciences which were traditionally taught in monastries. The light weight bound books are normally notebooks and diaries, which were more easily carried by officials and travellers. There are two main scripts from which several others derived. By identifying the script in an unknown text, the general classification of the text should be possible. The decoration of a Tibetan book will easily distinguish a religious text from a secular one, with its miniatures of Buddha and other gods. Always the most decorated manuscripts or prints will be of a religious nature, as it is a work of worship to create a book with the highest possible standards. The book wrappers are primarily a protection for the book and secondly a colour indication to which Lamaist sect it belongs. The colour blue identifies the book wrapper and the paper as a main ecclesiastic text. There is no differenciation to be made between Tibetan papers, because there is only one choice which may or may not painted and still is made in the original method using a wove mould, which Ts'ai-lun invented in 105 A.D. The fibre contents of the paper might give an indication as to the region in which the paper was made.

The protective materials are cloth, cotton, silk, wood and arsenic and are found either in Tibet itself or were imported from India or

China. Most of these materials have extraordinary protective properties. Cultural significance can be found in nearly all of these materials. Conservation problems arise when the materials are lost and have to be replaced.

Ten items were put at my disposal for research and conservation, which turned out to have 29 different types of paper. There was no literature available pertaining to the conservation of Tibetan books and scrolls.

The fibre analysis showed that most of the paper were made from pure Thymelaeaceae but there were also other fibres found such as Hemp, Cotton, Paper mulberry and Chinagras.

The typical Tibetan paper is wove and contains impurities of bud and leaf tissue, clearly visible and show a cloudy fibre distribution. Manuscript folios for pothi books are manufactured from several layers of paper. Usually the paper contains arsenic which is responsible for the lack of insect attack. The papers are mainly pale yellow/brown in tone, which derived from the colouration of the fibres or ingrained dirt. They are not dyed or bleached. The paper does not have a surface coating other then starch, and the amount of this makes them appear either coarse or smooth. The colour of the blue and yellow[116] papers is brushed on the surface, which is either indigo or orpiment in a mixture of hide glue. The centre of the folios where the text is written are polished to a glossy finish with a glass roller. The fibre contents of paper mulberry, chinagras or cotton is an indication that the paper may come from an area close to border countries or from a border country itself.

Three pigments were identified during the analysis as vermillion, orpiment and indigo, and two were classified as organic.

Four prayer scrolls were in question of their authenticity. Two could be identified as authentic, and two were not.

As there were no ethical considerations to be taken into account, I conserved six books and four scrolls. The treatments were minimal and carried out with the most sympathetic material available. The result of the conservation treatment is as little interferance with

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[116] The yellow paper was not researched in this thesis.

the original material as possible, which rendered the books and scrolls usable again.

Tibetan paper is usually in a much better condition then for example European or Arabic manuscripts. This is a result of the long fibred paper with no modern additives such as mechanical wood pulp or rosin and their protective materials. On the other hand very old manuscripts or printed books rarely survived because if they were damaged they were traditionally copied and then destroyed.

If I had had more time I would have liked to have carried out a more complex treatment of the blue pothi book rather than the less interventive which it received. As the conservation treatments were running parallel to the research the conservation of this object seemed to be too complicated and time consuming and therefore other objects were approached. I can now state that the cockled and brittle paper will regain its flexibility by lightly spraying with destilled water and pressing between blotters, which was the original method of production. The repair paper can be matched by brushing a mixture of indigo and hide glue on the surface. The repair can then be achieved by slipping the repair paper between the layers of the original paper.

Further investigations into this field should be done regarding the dating of the paper objects according to their constituants, because most of the objects are not dated. Marianne Harders-Steinhäuser[117] mentions a differentiation according to the starch content, but does not give any dates. I hope to continue this research in the future.

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[117] M. Harders-Steinhäuser. "Mikroskopische Untersuchungen einiger früher ostasiatischer Tun-huang Papiere". p.274.

Appendix I

Major collections of Tibetan books and manuscripts are to be found in the following countries other then Tibet or China[118] :

CSFR:

Archiv Orientalni (Prague).

France:

Bibliothèque de l'Institut de France (Paris), Bibliothèque National (Paris)

Germany:

Staats- und Universitätsbibliothek München (Munich), Königlich Württembergische Landesbibliothek (Stuttgart), Linden Museum (Stuttgart), Museum für Völkerkunde (Leipzig), Preußischer Kulturbesitz - Staatsbiliothek (Berlin).

Great Britain:

British Museum (London), India Office Library (London), Victoria & Albert Museum (London), Liverpool Museum (Liverpool), Ashmolian Museum (Oxford), Bodlian Library (Oxford), Royal Asiatic Society (London), The Wellcome Institute (London).

India:

The National Museum (Delhi), Library of Tibetan Works and Archives (Dharamsala).

Italy:

Instituto Shang-Shung (Arcidosso).

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[118] This list is not supposed to be complet, but according to my knowledge.

Japan:

University of Tokyo (Tokyo), Temple Soji-ji (Yokohama), Otani University Library (Kyoto), Sakai Collection (Koyasan), Toyo Bunko - Kawaguchi Collection (Tokyo).

People's Republic of Mongolia:

The Central State Library (Ulan Bator).

Russia:

Asiatic Museum (Leningrad), Imperial Academy (St. Petersburg).

U.S.A.:

Newark Museum (Newark, New Jersey).

Appendix II

Conservation Documentation

Horniman Museum No.: NN 1697

Description

Object:	Paper scroll from prayer-wheel
Title:	Different mantras: "Manjushri, Avalokite's vara, Vajrapami, Amitayus, White Tara, Vijaya". Aspirational prayers for good furtune; prosperity and good health.
Author:	Unknown
Date:	Unknown
Provenance:	Tibet

Description of object

Dimensions:	57 x 873 mm.
Characteristics:	Printed in black ink on recto and verso. Made from one piece of paper. The head and tail edges are unevenly cut.

Description of paper

Characteristics:	Handmade. Wove with imprint of the cotton mould. Deckle edges on the right and left hand sides. Single-layered.
Thickness:	0,12 - 0,18 mm
Coated:	No
Tone:	White
Surface texture:	Coarse and soft

Condition

The paper scroll was very dirty and creased, because the lid of the prayer-wheel was squashed in. There was one small missing area.

Test Record

pH Record: 6.4; 6.7; 6.3; 6.4
Fibre Furnish: Thymelaeaceae
Spot Testing:
Lignin: negative
Alum: negative
Starch: negative
Rosin: negative
Arsenic: positive

Fugitivity Tests:

	H_2O dest.	IMS	IMS / H_2O 50%/50%
black ink	+	+	+

Treatment

MATERIAL USED	TREATMENT
Brush	Brushed paper in the fume hood.
Distilled water	Spray relaxed and slightly pressed the paper.
Paper H5 from Nepal Rice starch 10% w/v	Filled in missing area from both sides.
	Rerolled the paper scroll.

Material Used

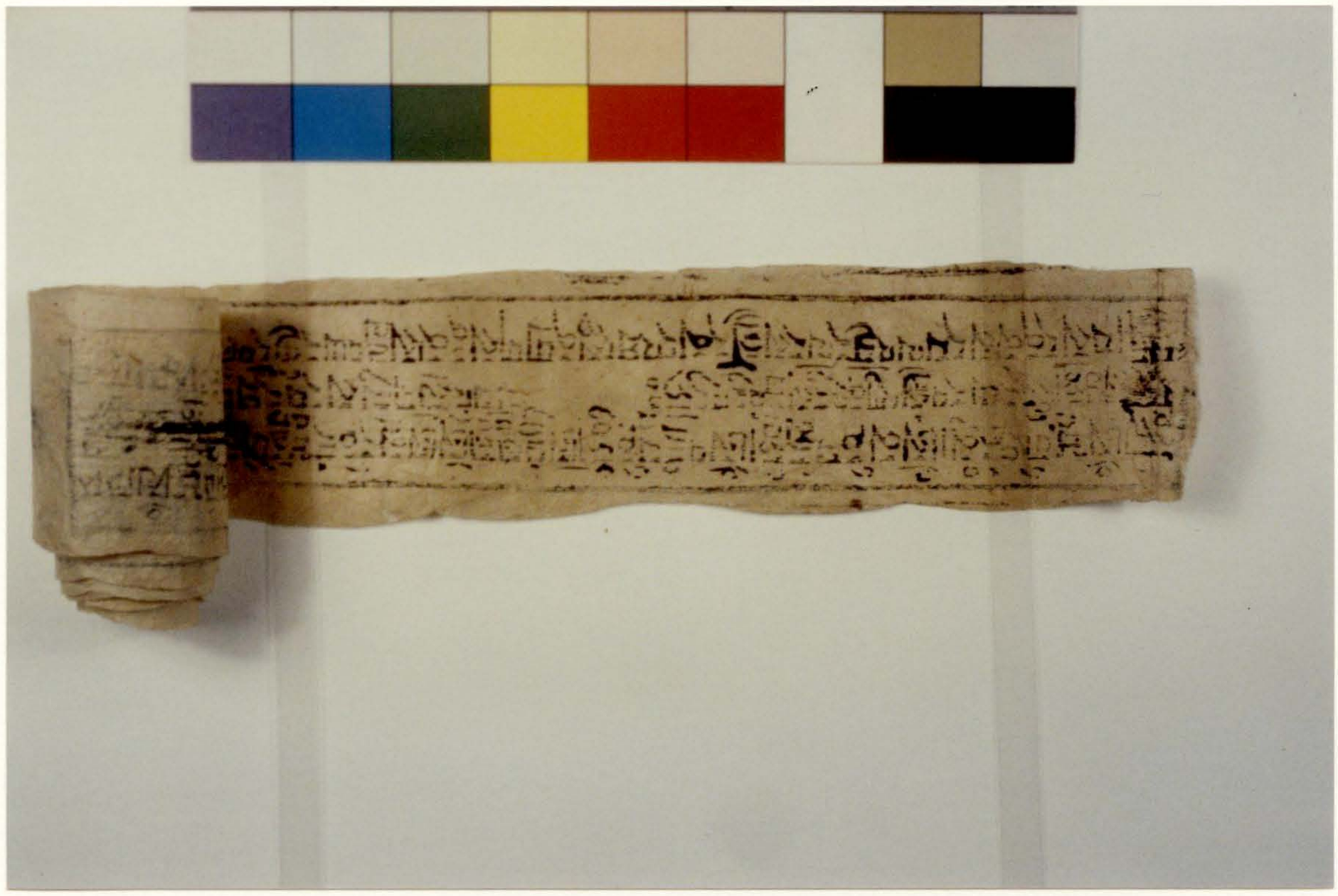
Paper H5
Thin off white handmade
Daphne paper from Nepal

Rice starch
Prod. 30263 / 9896410F

Suppliers

Khadi Papers, Childgrove,
Chichester PO18 9HU

BDH Chemicals Ltd. Poole
England



No.32 Horniman Museum NN 1697 Prayer scroll after treatment.

Horniman Museum No.: 1983.90

Description

Object:	Book folio folded and rolled into scroll form which had been placed inside a prayer-wheel.
Title:	Extracts from some Sanskrit verses, a religious Buddhist song, which begins in the middle of verse 15 up to verse 21.
Author:	Unknown
Date:	Unknown
Provenance:	Possibly Nepalese.

Description of object

Dimensions:	87 x 137 mm
Characteristics:	Manuscript, written in black and red ink with a yellow and red painted frame around the writing on recto and verso.

Description of paper

Characteristics:	Handmade. Laid. Single-layered.
Thickness:	0,07 - 0,11 mm
Coated:	No
Tone:	Brown
Surface texture:	Polished

Condition

The folio was covered in dirt. It had two holes and several missing areas at the edges. There were tears in the folio as well as along the edges. The surface was badly abraded.

Test Record

pH Record: 5.6; 5.5; 5.4; 5.5
Fibre Furnish: Paper mulberry
Spot Testing:
Lignin: negative
Alum: negative
Starch: positive
Rosin: negative
Arsenic: negative

Fugitivity Tests:

	H_2O dest.	IMS	IMS / H_2O 50%/50%
black ink	-	-	-
pigments:			
red	-	-	-
yellow	-	-	-

Treatment

MATERIAL USED	TREATMENT
Brush	Brushed paper in the fume hood.
Distilled water	Spray relaxed the paper and lightly pressed.
Paper tissue TP1 from Thailand Rice starch 10% w/v	Repaired the tears and filled in holes and missing areas from both sides.
	Folded and rerolled folio into a prayer scroll form.

Material Used	Suppliers
Paper TP1 Thin handmade Mulberry tissue from Thailand, pH 8.0	Khadi Papers, Childgrove, Chichester PO18 9HU
Rice starch Prod. 30263 / 9896410F	BDH Chemicals Ltd. Poole England

No.33 Horniman Museum 1983.90 Book folio after treatment.

Horniman Museum No.: NN 1696

Description

Object:	Paper scroll from prayer-wheel
Title:	Sutra. For the confession of sins and negativity.
Author:	Unknown
Date:	Unknown
Provenance:	Tibet

Description of object

Dimensions:	41 x 1167 mm
Characteristics:	Manuscript, written in blue ink on recto and verso. Made from one piece of paper. The head and tail edges are unevenly cut.

Description of paper

Characteristics:	Handmade. Wove. Deckle edges on the right and left hand sides. Single-layered.
Thickness:	0,11 - 0,18 mm
Coated:	No
Tone:	White
Surface texture:	Coarse and soft

Condition

The scroll was covered in heavy surface dirt. The paper had lots of little holes and tears and it seemed as it may have been chewed by a rat. There were surface abrasions.

Test Record:

pH Record:	5.5; 5.2; 5.7; 6.0	
Fibre Furnish:	Hemp and Thymelaeaceae	
Spot Testing:	Lignin:	negative
	Alum:	negative
	Starch:	positive
	Rosin:	negative
	Arsenic:	negative

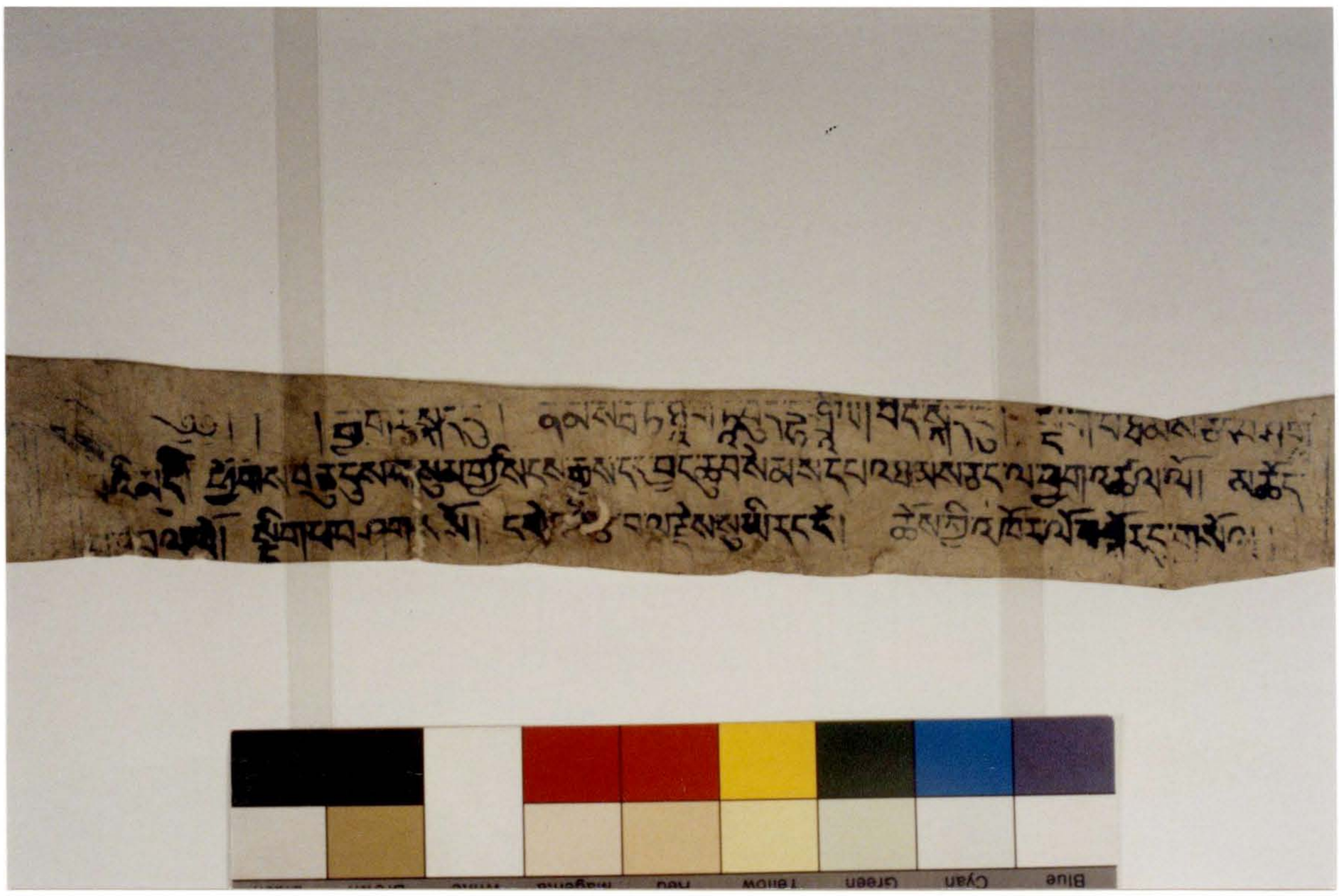
Fugitivity Tests:

	H_2O dest.	IMS	IMS / H_2O 50%/50%
blue ink	+	+	+

Treatment

MATERIAL USED	TREATMENT
Brush	Brushed paper in the fume hood.
Destilled water	Spray relaxed paper and lightly pressed.
Paper tissue TP1 from Thailand Rice starch 10% w/v	Repaired the paper tears.
Paper H5 from Nepal Rice starch 10% w/v	Filled in missing areas and holes from both sides.
	Rerolled paper scroll.

Material Used	Suppliers
Paper H5 Thin off white handmade Daphne paper from Nepal	Khadi Papers, Childgrove, Chichester PO18 9HU
Paper TP1 Thin handmade Mulberry tissue from Thailand, pH 8.0	Khadi Papers, Childgrove, Chichester PO18 9HU
Rice starch Prod. 30263 / 9896410F	BDH Chemicals Ltd. Poole England



No.34 Horniman Museum NN 1696 Paper scroll after treatment.

Horniman Museum No.: 6.12.65/65

Description

Object:	Book folio folded and rolled into scroll form and placed inside a prayer-wheel.
Title:	Teaching. Clarifying the stage between death and rebirth, from the "Book of the Death".
Author:	Unknown
Date:	Unknown
Provenance:	Tibet

Description of object

Dimensions:	90 x 330 mm
Characteristics:	Printed in black ink on recto and verso.

Description of paper

Characteristics:	Handmade. Wove. Single-layered
Thickness:	0,11 - 0,48 mm
Coated:	No
Tone:	White
Surface texture:	Coarse surface

Condition

The book folio was covered in heavy dirt. It was creased, and there was one small missing area.

Test Record

pH Record:	6.4; 6.4; 6.3; 6.5	
Fibre Furnish:	Thymelaeaceae	
Spot Testing:	Lignin:	positive
	Alum:	positive
	Starch:	positive
	Rosin:	negative
	Arsenic:	positive

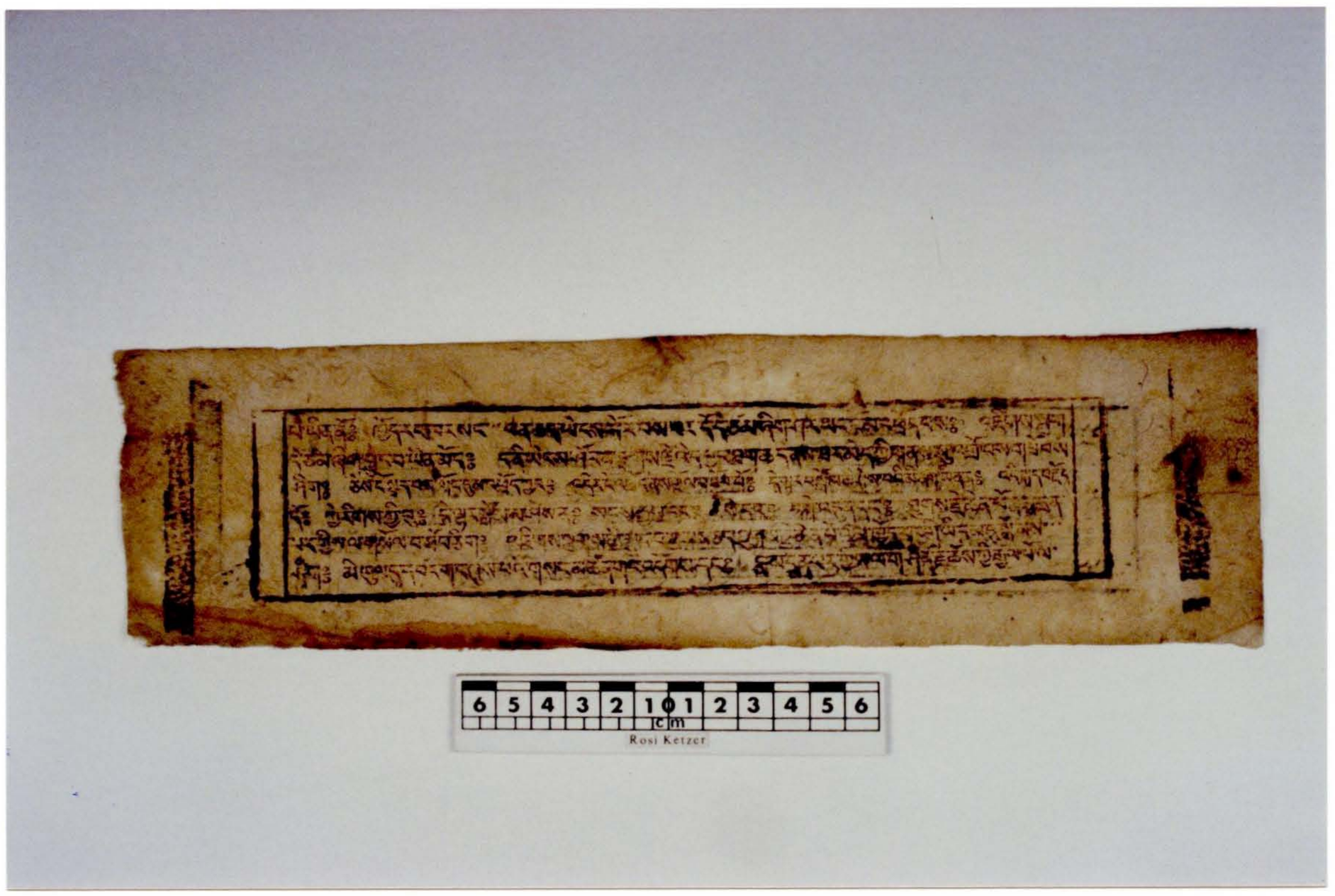
Fugitivity Tests:

	H_2O dest.	IMS	IMS / H_2O 50%/50%
black ink	-	-	+

Treatment

MATERIAL USED	TREATMENT
Brush	Brushed the paper in the fume hood.
Distilled water	Spray relaxed and paper lightly pressed.
Paper H5 from Nepal Rice starch 10% w/v	Filled in missing area from both sides.
	Refolded and rerolled folio into scroll form.

Material Used	Suppliers
Paper H5 Thin off white handmade Daphne paper from Nepal	Khadi Papers, Childgrove, Chichester PO18 9HU
Rice starch Prod. 30263 / 9896410F	BDH Chemicals Ltd. Poole England



No.35 Horniman Museum 6.12.65/65 Book folio after treatment.

Royal Asiatic Society No.: Manuscript 5

Description

Object:	Pothi book
Title:	Collection of fragments (1) Sign (2). Fol. 25, 30 - 33, 41. (2) Sign (14). Fol. 3, 20 (?), 23 - 30, 32, 34 (3) Sign (17). Fol. 6 - 12. Firm writing. (4) "Subhabusmatamgha, Gser od dam · pai sna rgai gruns." Fol. 14, lines 6 (desunt 4, 11), signed W (24), and, from fol. 7 on I. (25). (5) "Çatasahasrika prajña paramita". Fol. 2. (6) Fol. 1. End folio, number 10, lines 2. (7) "Vajracchedika". Fol. 1. (8) "Vajracchedika". Title page yellow on blue. 1 fol., and 16 stray folios from different works.
Author:	Unknown
Date:	Unknown, but was owned by Brian Houghton Hodgson (1800-1894) who lived in India and Nepal from 1818 to 1858, and this may give an indication as to its age.
Provenance:	Tibet

Description of object

Dimensions:	There are 16 different dimensions within the group of folios
	pp.1-6 : 155 x 499 mm
	pp.7-17 : 189 x 511 mm
	pp.18-26 : 155 x 491 mm
	pp.27-29 : 165 x 502 mm
	pp.30-37 : 155 x 499 mm
	pp.38-39 : 201 x 601 mm
	p.40 : 134 x 412 mm
	p. 41 : 149 x 499 mm
	p. 42 : 174 x 462 mm
	pp.43-44 : 133 x 442 mm
	pp.45-46 : 151 x 438 mm
	p. 47 : 165 x 497 mm
	p. 48 : 155 x 485 mm
	pp.49-56 : 148 x 495 mm
	p. 57 : 150 x 494 mm
	p. 58 : 151 x 496 mm

Characteristics:	Manuscript, written in black ink with red or brown lines on recto and verso. Folio 42 is a titlepage, made from three folios, sewn together with blue paper thongs. The folio in the centre has writing in yellow ink on dark blue painted paper.
Number of folios:	58
Pagination:	In Tibetan on recto top left hand side.
Boards:	Cardboard
Wrapper:	None

Description of paper

pp.1-6

Characteristics:	Handmade. Wove. Six-layered.
Thickness:	0,35 - 0,51 mm
Coated:	No
Tone:	Pale brown
Surface texture:	Smooth

pp.7-17

Characteristics:	Handmade. Wove. Three-layered.
Thickness:	0,31 - 0,49 mm
Coated:	No
Tone:	Pale brown
Surface texture:	Coarse

pp.18-26

Characteristics:	Handmade. Wove. Four-layered.
Thickness:	0,32 - 0,78 mm
Coated:	No
Tone:	Pale brown
Surface texture:	Coarse

pp.27-29

Characteristics:	Handmade. Wove. Four-layered.
Thickness:	0,21 - 0,37 mm
Coated:	No
Tone:	Pale brown
Surface texture:	Smooth

pp.30-37

Characteristics:	Handmade. Wove. Three-layered.
Thickness:	0,18 - 0,60 mm
Coated:	No
Tone:	Pale brown
Surface texture:	Smooth

pp.38-39
Characteristics: Handmade. Wove. Two-layered.
Thickness: 0,30 - 0,64 mm
Coated: No
Tone: Pale brown
Surface texture: Coarse

p.40
Characteristics: Handmade. Wove. Six-layered.
Thickness: 0,49 - 0,68 mm
Coated: No
Tone: Pale brown
Surface texture: Coarse

p. 41
Characteristics: Handmade. Wove. Two-layered.
Thickness: 0,26 - 0,53 mm
Coated: No
Tone: Pale brown
Surface texture: Smooth

p. 42
Characteristics: Handmade. Wove. Seven-layered.
Thickness: 1,17 - 1,78 mm
Coated: No, but the centre folio.
Tone: Pale brown yellow, but the centre folio is dark blue.
Surface texture: Coarse, but the centre folio is polished.

pp.43-44
Characteristics: Handmade. Wove. Four-layered.
Thickness: 0,12 - 0,27 mm
Coated: No
Tone: Pale brown yellow soft
Surface texture: Coarse and soft

pp.45-46
Characteristics: Handmade. Wove. Six-layered.
Thickness: 0,34 - 0,59 mm
Coated: No
Tone: Pale brown yellow soft
Surface texture: Coarse and soft

p. 47
Characteristics: Handmade. Wove. Two-layered.
Thickness: 0,16 - 0,24 mm
Coated: No
Tone: Pale brown yellow
Surface texture: Coarse and soft

p. 48
Characteristics: Handmade. Wove. Three-layered.
Thickness: 0,18 - 0,84 mm
Coated: No
Tone: Pale brown yellow
Surface texture: Coarse and soft

pp.49-56
Characteristics: Handmade. Wove. Two-layered.
Thickness: 0,21 - 0,48 mm
Coated: No
Tone: Pale brown yellow
Surface texture: Coarse and soft

p. 57
Characteristics: Handmade. Wove. Two-layered.
Thickness: 0,18 - 0,43 mm
Coated: No
Tone: Pale brown yellow
Surface texture: Coarse and soft

p. 58
Characteristics: Handmade. Wove. Eight-layered.
Thickness: 0,47 - 0,86 mm
Coated: No
Tone: Pale brown yellow
Surface texture: Coarse and soft

Condition
The original book boards and the wrapper were missing. The paper folios had very heavy covering of dirt. The paper edges were damaged at the right and lelft hand sides because the cardboard covers were too small, which resulted in tears and missing areas. There were rust spots, holes from woodworm, paper loss because of mould growth due to water damage. There were also obvious water stains and evidence of different types of mould due to colours of staining.

Test Record

pp.1-6
pH Record: 5.8; 6.9; 6.2; 7.0
Fibre Furnish: Chinagras and Paper mulberry.
Spot Testing:
Lignin: negative
Alum: negative
Starch: negative
Rosin: negative
Arsenic: positive

Fugitivity Tests:

Ink	H_2O dest.	IMS	IMS / H_2O 50%/50%
black	-	-	+
Red/brown	+	+	+

pp.7-17
pH Record: 7.0; 7.9; 7.9; 6.8
Fibre Furnish: Thymelaeaceae
Spot Testing:
Lignin: negative
Alum: positive
Starch: positive
Rosin: negative
Arsenic: negative

Fugitivity Tests:

Ink	H_2O dest.	IMS	IMS / H_2O 50%/50%
Black	-	-	-
Red/brown	+	-	+

pp.18-26
pH Record: 6.6; 7.0; 6.6; 6.3
Fibre Furnish: Cotton and Thymelaeaceae
Spot Testing:
Lignin: negative
Alum: negative
Starch: positive
Rosin: negative
Arsenic: negative

Fugitivity Tests:

Ink	H_2O dest.	IMS	IMS / H_2O 50%/50%
Black	+	-	+
Red/brown	-	-	-

pp.27-29
pH Record: 6.6; 6.6; 6.7; 6.7
Fibre Furnish: Thymelaeaceae
Spot Testing:
Lignin: negative
Alum: positive
Starch: positive
Rosin: negative
Arsenic: positive

Fugitivity Tests:

Ink	H_2O dest.	IMS	IMS / H_2O 50%/50%
Black	-	-	+
Red/brown	-	-	+

pp.30-37
pH Record: 6.5; 6.1; 6.7; 6.6
Fibre Furnish: Hemp and Paper mulberry
Spot Testing:
Lignin: negative
Alum: negative
Starch: positive
Rosin: negative
Arsenic: negative

Fugitivity Tests:

Ink	H_2O dest.	IMS	IMS / H_2O 50%/50%
Black	-	-	-
Red	-	-	-

pp.38-39
pH Record: 5.4; 6.3; 6.4; 5.0
Fibre Furnish: Thymelaeaceae
Spot Testing:
Lignin: negative
Alum: positive
Starch: negative
Rosin: negative
Arsenic: positive

Fugitivity Tests:

Ink	H_2O dest.	IMS	IMS / H_2O 50%/50%
Black	+	-	-
Red	-	-	-

p.40
pH Record: 6.7; 6.0; 6.7; 6.6
Fibre Furnish: Paper mulberry and Thymelaeaceae
Spot Testing:
Lignin: negative
Alum: negative
Starch: positive
Rosin: negative
Arsenic: positive

Fugitivity Tests:

Ink	H_2O dest.	IMS	IMS / H_2O 50%/50%
Black	+	+	+
Red	-	-	-

p.41
pH Record: 7.2; 6.5; 5.7; 5.9
Fibre Furnish: Thymelaeaceae
Spot Testing:
Lignin: negative
Alum: positive
Starch: negative
Rosin: negative
Arsenic: negative

Fugitivity Tests:

Ink	H_2O dest.	IMS	IMS / H_2O 50%/50%
Black	-	+	-
Red	-	-	-

p.42

pH Record:	6.0; 6.7; 7.3; 6.6		
Fibre Furnish:	Thymelaeaceae		
Spot Testing:	Lignin:	negative	
	Alum:	negative	
	Starch:	negative	
	Rosin:	negative	
	Arsenic:	negative	

Fugitivity Tests:

Pigment	H_2O dest.	IMS	IMS / H_2O 50%/50%
Blue	+	+	+
Red	–	–	–
Yellow	+	–	–
Green	+	–	–
Black	–	–	–

pp.43-44

pH Record:	6.2; 6.4; 6.2; 7.0		
Fibre Furnish:	Thymelaeaceae		
Spot Testing:	Lignin:	negative	
	Alum:	negative	
	Starch:	negative	
	Rosin:	negative	
	Arsenic:	positive	

Fugitivity Tests:

Ink	H_2O dest.	IMS	IMS / H_2O 50%/50%
Black	+	+	+
Red	–	–	–

pp.45-46

pH Record:	6.3; 6.2; 6.6; 5.6		
Fibre Furnish:	Thymelaeaceae amd Paper mulberry		
Spot Testing:	Lignin:	negative	
	Alum:	negative	
	Starch:	positive	
	Rosin:	negative	
	Arsenic:	negative	

Fugitivity Tests:

Ink	H_2O dest.	IMS	IMS / H_2O 50%/50%
Black	+	+	+
Red	–	–	–

p.47
pH Record: 6.1; 6.4; 5.1; 5.6
Fibre Furnish: Thymelaeaceae
Spot Testing: Lignin: negative
Alum: negative
Starch: positive
Rosin: negative
Arsenic: positive

Fugitivity Tests:

Ink	H_2O dest.	IMS	IMS / H_2O 50%/50%
Black	+	–	+
Red	+	–	–

p.48
pH Record: 6.4; 6.2; 5.9; 6.6
Fibre Furnish: Thymelaeaceae
Spot Testing: Lignin: negative
Alum: negative
Starch: negative
Rosin: negative
Arsenic: positive

Fugitivity Tests:

Ink	H_2O dest.	IMS	IMS / H_2O 50%/50%
Black	+	+	–
Red	–	+	–

pp.49-56
pH Record: 6.7; 6.1; 6.4; 6.2
Fibre Furnish: Cotton and Thymelaeaceae
Spot Testing: Lignin: negative
Alum: negative
Starch: negative
Rosin: negative
Arsenic: positive

Fugitivity Tests:

Ink	H_2O dest.	IMS	IMS / H_2O 50%/50%
Black	+	+	+
Red	–	–	–

p.57
pH Record: 5.6; 6.3; 5.4; 5.8
Fibre Furnish: Thymelaeaceae
Spot Testing: Lignin: negative
Alum: negative
Starch: positive
Rosin: negative
Arsenic: positive

Fugitivity Tests:

Ink	H_2O dest.	IMS	IMS / H_2O 50%/50%
Black	+	–	+
Red	–	–	–

p.58

pH Record: 5.5; 5.8; 5.4; 5.4

Fibre Furnish: Thymelaeaceae

Spot Testing:

Lignin:	negative
Alum:	negative
Starch:	positive
Rosin:	negative
Arsenic:	negative

Fugitivity Tests:

Ink	H_2O dest.	IMS	IMS / H_2O 50%/50%
Black	-	-	-
Brown/red	-	+	+

Treatment

MATERIAL USED	TREATMENT
Brush	Brushed paper in the fume hood.
Seasoned walnut board Museum Barrier cardboard Scotch animal glue	Made new boards for the pothi book. The walnut boards (207x 610 mm) were ready cut to size with bevelled edges. Sanded the walnut boards and cut the Museum Barrier cardboard 1 mm smaller around the edges than the wooden boards. Glued the cardboard to the wooden boards with animal glue and pressed them.
Undied silk Silk thread Col. 802	Made a new wrapper. Cut the silk to size (1430 x 1430 mm) plus a ribbon (1000 x 10 mm). Pieces sewn together and hemmed the edges with silk thread.

Material Used	Suppliers
Seasoned walnut board	Limehouse Timber LTD, 18 Robert Leonard Ind. Est., Stock Road, Southend On Sea, Essex SS2 5QD.
Museum Barrier cardboard 300g, pH 7,2 ply / 500 micron, ivory.	Arquati UK Ltd., 2 Wolsley Rd., Kempston, Bedford MK42 7AY.

Scotch animal glue	J. Hewit & Sons Ltd., Unit 28, Park Royal Metro Centre, Britannia Way, Park Royal NW10 7PR.
Undied silk	David Evans & Co., Bourne Road, Crayford, Kent DA1 4BP
Silk thread Gütermann S 303, Col. 802	John Lewis, Oxford Street, London.

Royal Asiatic Society No.: Print 7

Description

Object:	Pothi book
Title:	"Rgyun · gtor khrigs · su bkod · pa" (Coherent exposition of perpetual offering). A ritual.
Author:	Unknown
Date:	Unknown, but was owned by Brian Houghton Hodgson (1800-1894) who lived in India and Nepal from 1818 to 1858, and this may give an indication as to its age.
Provenance:	Tibet

Description of object

Dimensions:	86 x 505 mm
Characteristics:	Text printed in black ink on recto and verso. Seven lines to a page.
Number of folios:	16
Pagination:	In Tibetan on recto top left hand side.
Boards:	None
Wrapper:	None

Description of paper

Characteristics:	Handmade. Wove. Single-layered.
Thickness:	0,13 - 0,56 mm
Coated:	No
Tone:	Brown
Surface texture:	Coarse

Condition

The book boards and wrapper were missing. There was heavy covering of dirt on the folios. The title page had a library label glued to it, and the glue had migrated into the second page. There were water stains and a few insect holes. Many of the paper edges were creased and frayed.

Test Record

pH Record: 5.3; 6.2; 6.2; 5.9
Fibre Furnish: Thymelaeaceae
Spot Testing:
Lignin: negative
Alum: negative
Starch: positive
Rosin: negative
Arsenic: negative

Fugitivity Tests:

	H_2O dest.	IMS	IMS / H_2O 50%/50%
Black ink	-	-	-

Treatment

MATERIAL USED	TREATMENT
Brush	Brushed paper in the fume hood.
Seasoned walnut board Museum Barrier cardboard Scotch animal glue	Made new boards for the pothi book. The walnut boards (100x 520 mm) were ready cut to size with bevelled edges. Sanded the walnut boards and cut the Museum Barrier cardboard 1 mm smaller around the edges than the wooden boards. Glued the cardboard to the wooden boards with animal glue and pressed.
Undied silk Silk thread Col. 802	Made a new wrapper. Cut the silk to size (1120 x 1120 mm) plus a ribbon (1000 x 10 mm). Pieces sewn together and hemmed the edges with silk thread.

Material Used	Suppliers
Seasoned walnut board	Limehouse Timber LTD, 18 Robert Leonard Ind. Est., Stock Road, Southend On Sea, Essex SS2 5QD.
Museum Barrier cardboard 300g, pH 7, 2 ply / 500 micron, ivory.	Arquati UK Ltd., 2 Wolsley Rd., Kempston, Bedford MK42 7AY.

Scotch animal glue	J. Hewit & Sons Ltd., Unit 28, Park Royal Metro Centre, Britannia Way, Park Royal NW10 7PR.
Undied silk	David Evans & Co., Bourne Road, Crayford, Kent DA1 4BP
Silk thread Gütermann S 303 Col. 802	John Lewis, Oxford Street

Royal Asiatic Society No.: Print 12

Description

Object:	Pothi book
Title:	"Bla · mai gsol dẽbs sbyin rlabs myur jug" (The Guru's prayer: Quick entrance to blessing).
Author:	Unknown
Date:	Unknown, but was owned by Brian Houghton Hodgson (1800-1894) who lived in India and Nepal from 1818 to 1858, and this may give an indication as to its age.
Provenance:	Tibet

Description of object

Dimensions:	90 x 406 mm (unfolded sheets 180 x 406 mm)
Characteristics:	Text printed with black ink on recto. Four lines to a page. The folios are double sheets folded over the longer head side.
Number of folios:	6
Pagination:	In Tibetan on recto top left hand side.
Boards:	None
Wrapper:	None

Description of paper

Characteristics:	Handmade. Wove with imprint of the cotton mould. Single-layered.
Thickness:	0,12 - 0,41 mm
Coated:	No
Tone:	Pale yellow
Surface texture:	Coarse and soft

Condition

The book boards and the wrapper were missing. There was heavy dirt deposits all over the folios. Most folios had water stains and in the same area mould stains. The first folio was badly torn and creased, especialy in the middle where a ribbon held the folios together. There was a library label glued on the first folio and the glue had migrated into the second folio.

Test Record

pH Record: 5.6; 5.4; 5.3; 5.5
Fibre Furnish: Thymelaeaceae
Spot Testing:
Lignin: negative
Alum: negative
Starch: positive
Rosin: negative
Arsenic: negative

Fugitivity Tests:

	H_2O dest.	IMS	IMS / H_2O 50%/50%
Black ink	+	+	+

Treatment

MATERIAL USED	TREATMENT
Brush	Brushed paper in the fume hood.
Seasoned walnut board Museum Barrier cardboard Scotch animal glue	Made new boards for the pothi book. The walnut boards (99 x 421 mm) were ready cut to size with bevelled edges. Sanded the walnut boards and cut the Museum Barrier cardboard 1 mm smaller around the edges than the wooden boards. Glued the cardboard to the wooden boards with animal glue and pressed.
Undied silk Silk thread Col. 802	Made a new wrapper. Cut the silk to size (900 x 900 mm) plus a ribbon (1000 x 10 mm). Pieces sewn together and hemmed the edges with silk thread.

Material Used	Suppliers
Seasoned walnut board Raw cut boards.	Limehouse Timber LTD, 18 Robert Leonard Ind. Est., Stock Road, Southend On Sea, Essex SS2 5QD.
Museum Barrier cardboard 300g, pH 7, 2 ply / 500 micron, ivory.	Arquati UK Ltd., 2 Wolsley Rd., Kempston, Bedford MK42 7AY.

Scotch animal glue	J. Hewit & Sons Ltd., Unit 28, Park Royal Metro Centre, Britannia Way, Park Royal NW10 7PR.
Undied silk	David Evans & Co., Bourne Road, Crayford, Kent DA1 4BP
Silk thread	John Lewis, Oxford Street

Gütermann S 303, Col. 802

Royal Asiatic Society No.: Print 13

Description

Object:	Pothi book with two large drawings.
Title:	"Dohakoçanama mahā mutra upadeça"
Author:	Unknown
Date:	Unknown, but was owned by Brian Houghton Hodgson (1800-1894) who lived in India and Nepal from 1818 to 1858, and this may give an indication as to its age.
Provenance:	Tibet

Description of object

Dimensions:	There are four different dimensions within the text block and two large drawings. pp.1-13 : 91 x 486 mm pp.14,15,18 : 86 x ca. 470 mm pp.16-17 : 72 x 450 mm p. 19 : 89 x 468 mm p. 20 : 510 x 490 mm p. 21 : 455 x 479 mm
Characteristics:	pp. 1-13 print pp. 14-18 manuscript p. 19 print pp. 20-21 drawings Text printed in black ink on recto and verso. Manuscripts written in black and red ink on recto and verso. The two large drawings are in black ink on verso and folded into the shape of the pothi book.
Number of folios:	19 and two large folded drawings.
Pagination:	In Tibetan on recto top left hand side.
Boards:	None
Wrapper:	None

Description of paper

pp.1-13

Characteristics:	Handmade. Wove. Single-layered.
Thickness:	0,12 - 0,22 mm
Coated:	No
Tone:	Brown
Surface texture:	Coarse

pp.14,15,18
Characteristics: Handmade. Wove. Single-layered.
Thickness: 0,11 - 0,29 mm
Coated: No
Tone: Grey
Surface texture: Smooth and soft

pp.16,17
Characteristics: Handmade. Wove. Two-layered.
Thickness: 0,11 - 0,35 mm
Coated: No
Tone: Pale yellow brown
Surface texture: Smooth

p.19
Characteristics: Handmade. Wove. Single-layered.
Thickness: 0,11 - 32 mm
Coated: No
Tone: Brown
Surface texture: Smooth

pp.20-21
Characteristics: Handmade. Wove. Single-layered.
Thickness: 0,12 - 0,62 mm
Coated: No
Tone: Pale brown
Surface texture: Coarse

Condition:

The book boards and the wrapper were missing. The paper was very brittle and had dark stained. It seemed as it the first 13 folios had been in a fire. There were many water stains on all folios. Most of the folios had missing areas at the right and left hand sides.
Both large drawings were in a very fragile condition with repairs of self adhesive labels. There were tears along the folds and missing areas at the edges.

Test Record:

pp.1-13
pH Record: 3.8; 4.0; 4.6; 4.1
Fibre Furnish: Thymelaeaceae
Spot Testing:
Lignin: negative
Alum: negative
Starch: positive
Rosin: negative
Arsenic: positive

Fugitivity Tests:

	H_2O dest.	IMS	IMS / H_2O 50%/50%
Black ink	+	-	+

pp.14,15,18
pH Record: 5.3; 4.4; 4.8; 4.9
Fibre Furnish: Thymelaeaceae
Spot Testing:
Lignin: positive
Alum: negative
Starch: negative
Rosin: negative
Arsenic: positive

Fugitivity Tests:

	H_2O dest.	IMS	IMS / H_2O 50%/50%
Black ink	-	-	-

pp.16,17
pH Record: 4.7; 3.9; 5.5; 4.3
Fibre Furnish: Thymelaeaceae
Spot Testing:
Lignin: positive
Alum: negative
Starch: positive
Rosin: negative
Arsenic: positive

Fugitivity Tests:

	H_2O dest.	IMS	IMS / H_2O 50%/50%
Black ink	-	-	-
Red ink	+	-	-

p.19
pH Record: 4.7; 5.5; 5.7; 5.5
Fibre Furnish: Thymelaeaceae
Spot Testing:
Lignin: negative
Alum: positive
Starch: positive
Rosin: negative
Arsenic: positive

Fugitivity Tests:

	H_2O dest.	IMS	IMS / H_2O 50%/50%
Black ink	+	-	+

pp. 20,21
pH Record: 4.5; 5.4; 5.9; 6.0
Fibre Furnish: Paper mulberry and Thymelaeaceae
Spot Testing:
Lignin: negative
Alum: positive
Starch: negative
Rosin: negative
Arsenic: positive

p.20
Fugitivity Tests:

	H_2O dest.	IMS	IMS / H_2O 50%/50%
Black ink	-	-	-

p.21
Fugitivity Tests:

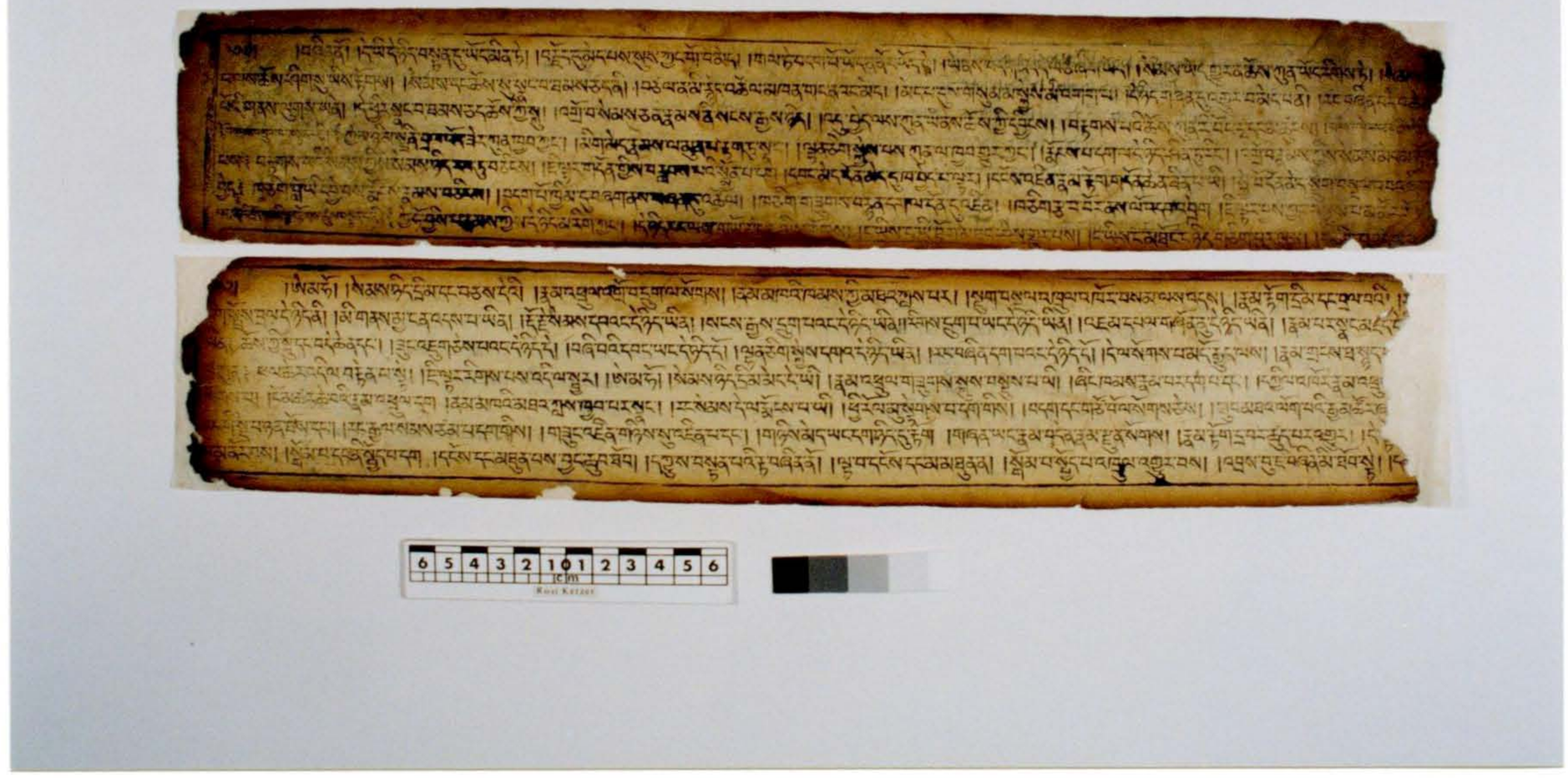
	H_2O dest.	IMS	IMS / H_2O 50%/50%
Black ink	+	+	+

Treatment

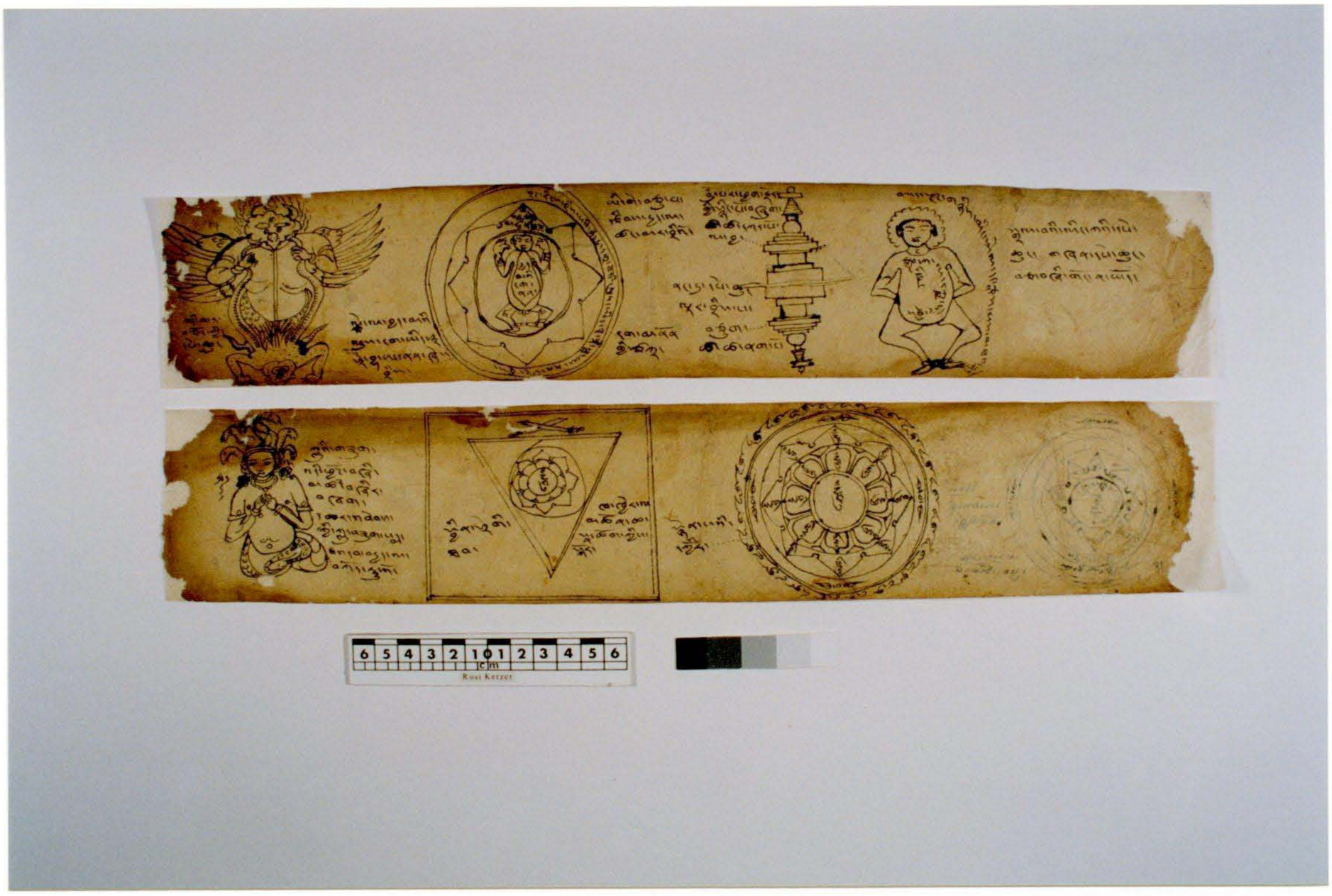
MATERIAL USED	TREATMENT
Brush	Brushed the paper in the fume hood.
Distilled water	Spray relaxed and paper lightly pressed.
Distilled water and acid-free blotting paper.	The paper was washed on wet blotter for a maximum of 5 min. The library label, the repairs and the dark staining was removed.
	Pressed lightly.
Paper H5 from Nepal Rice starch 10% w/v	Filled in missing areas from both sides.
Seasoned walnut board Museum Barrier cardboard Scotch animal glue	Made new boards for the pothi book. The walnut boards (106 x 504 mm) were ready cut to size with bevelled edges. Sanded the walnut boards and cut the Museum Barrier cardboard 1 mm smaller around the edges than the wooden boards. Glued the cardboard to the wooden boards with animal glue and pressed.
Undied silk Silk thread Col. 802	Made a new wrapper. Cut the silk to size (1100 x 1100 mm) plus a ribbon (1000 x 10 mm). Pieces sewn together and hemmed the edges with silk thread.

Material Used	Suppliers
Acid-free blotter pH 7, 300 & 140 g/m^2	Ford Gold Medal Blotter Wiggings Teape Paper Ltd., 34 Marshgate Lane, Stratford EI5 2NT.
Paper H5 Thin off white handmade Daphne paper from Nepal	Khadi Papers, Childgrove, Chichester PO18 9HU

Rice starch Prod. 30263 / 9896410F	BDH Chemicals Ltd. Poole England
Seasoned walnut board Raw cut boards.	Limehouse Timber LTD, 18 Robert Leonard Ind. Est., Stock Road, Southend On Sea, Essex SS2 5QD.
Museum Barrier cardboard 300g, pH 7, 2 ply / 500 micron, ivory.	Arquati UK Ltd., 2 Wolsley Rd., Kempston, Bedford MK42 7AY.
Scotch animal glue	J. Hewit & Sons Ltd., Unit 28, Park Royal Metro Centre, Britannia Way, Park Royal NW10 7PR.
Undied silk	David Evans & Co., Bourne Road, Crayford, Kent DA1 4BP
Silk thread Gütermann S 303, Col. 802	John Lewis, Oxford Street

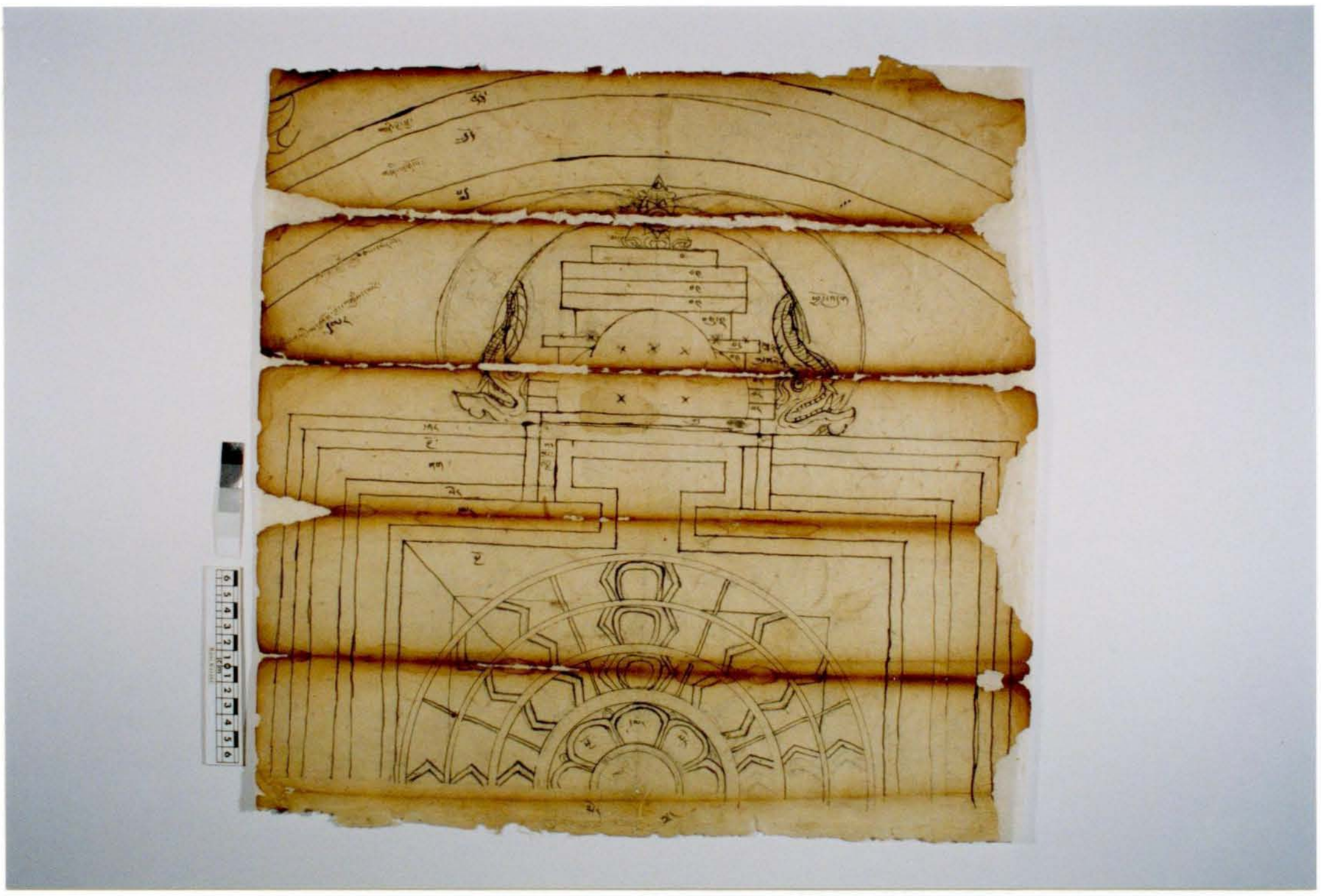


No.36 Royal Asiatic Society No. 13 Pothi book after treatment.



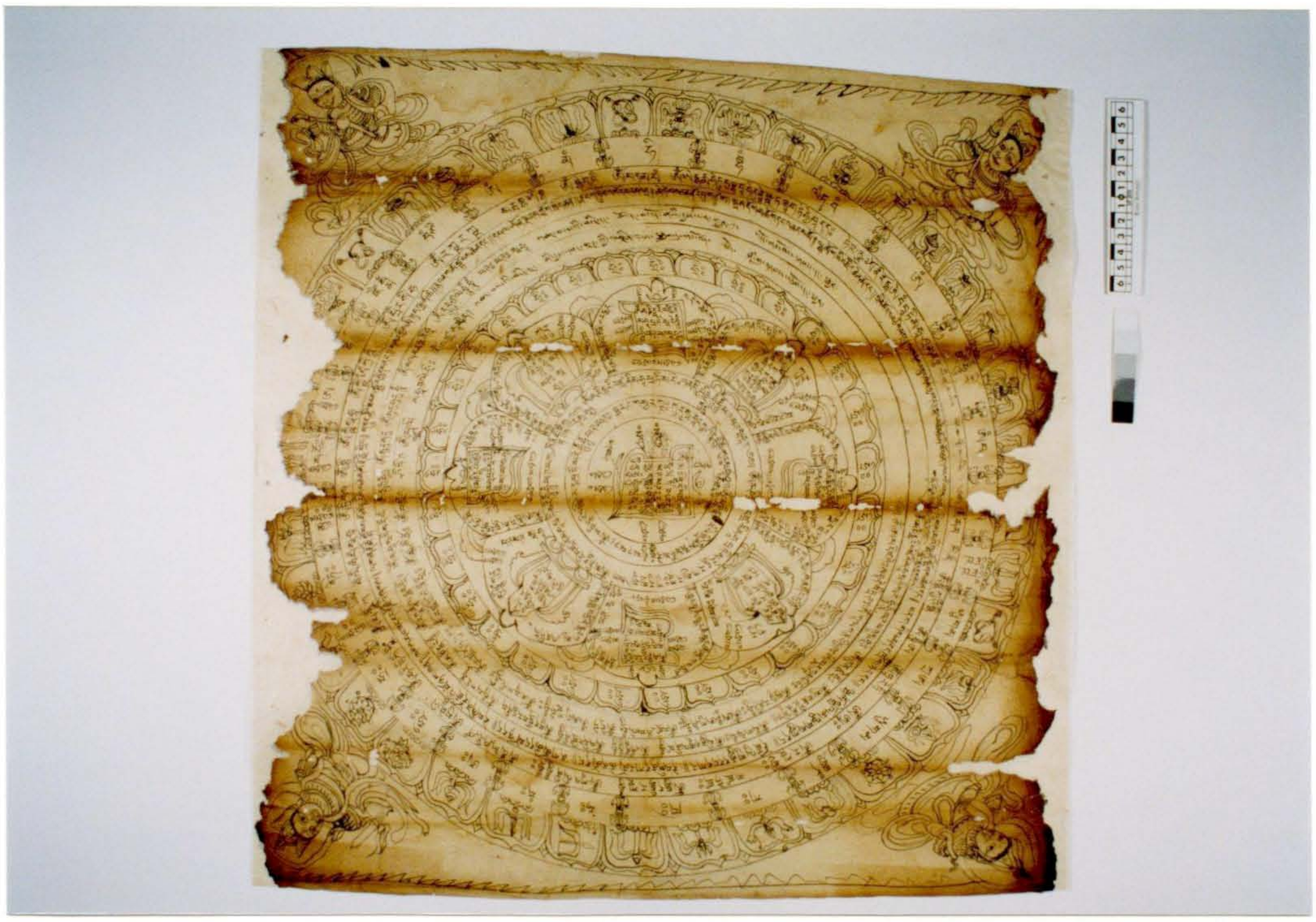
No.37 Royal Asiatic Society No.13 Pothi book after treatment.

No.38 Royal Asiatic Society No.13 Pothi book after treatment.



No.39 Royal Asiatic Society No.13 Large drawing from pothi book after treatment. Recto.

No.40 Royal Asiatic Society No.13 Large drawing from pothi book after treatment. Verso.



No.41 Royal Asiatic Society No.13 Large drawing from pothi book after treatment. Recto.

No.42 Royal Asiatic Society No.13 Large drawing from pothi book after treatment. Verso.

Wellcome Institute No.: Tibetan 11b

Description

Object:	Pothi book
Title:	"Rdo jde rnam par 'joms pa'i gzuns, Vajravidarananamadharani" (Incantation of all Conquering Indestructible Reality)
Author:	Unknown
Translaters:	Jinamitra, Danasila and Ye-ses-sde.
Date:	Unknown
Provenance:	Tibet

Description of object

Dimensions:	Boards 115 x 340 mm. Folios 109 x 337 mm
Characteristics:	Manuscript, written in yellow and white ink on recto and folio. Five lines to a page in the dbu-chan style. The title page has a green silk curtain and a paper mount.
Number of folios:	30
Pagination:	In Tibetan on recto top left hand side.
Boards:	Painted wooden boards (red, yellow, green, black) with bevelled edges on the longer sides, and carvings on one edge of the shorter sides.
Wrapper:	None. There is a white leather strap with a metal buckle to hold the book together.

Description of paper

Characteristics:	Handmade. Wove. Three-layered.
Thickness:	0,18 - 0,29 mm
Coated:	Polish in the text area.
Tone:	Dark blue. (The middle layer of the three-layered paper is white.)
Surface texture:	Smooth. Matt at the edges and shiny in the centre of the folios.

Condition

The wrapper was missing. The book has overal black greasy surface dirt. The paper has many stains. It is generally very brittle and cockled. The layers of the paper are split at some edges, and all the pages have missing areas along edges. The paper mount from the title page is torn

and has missing areas. The silk curtain is torn and only a third is left. The wooden boards are very worn, and there is pigment loss in several places. The leather strap is very worn and has lost most of its white colouring.

Test Record:

pH Record:	5.4; 5.9; 5.1; 5.6		
Fibre Furnish:			
Paper:	Thymelaeaceae and Paper mulberry		
Boards:	Not identified		
Spot Testing:	Lignin:	negative	
	Alum:	negative	
	Starch:	positive	
	Rosin:	negative	
	Arsenic:	positive	

Fugitivity Tests:

	H_2O dest.	IMS	IMS / H_2O 50%/50%
Blue pigment	-	-	-
yellow ink	-	-	-
white ink	-	-	-

Pigment Identification:
Blue: Indigo

Treatment

MATERIAL USED	TREATMENT
Brush	Brushed the paper in the fume hood.
Undied silk Silk thread Col. 802	Made a new wrapper. Cut the silk to size (880 x 880 mm) plus a ribbon (1000 x 10 mm). Pieces sewn together and hemmed the edges with silk thread.

Material Used	Suppliers
Undied silk	David Evans & Co., Bourne Road, Crayford, Kent DA1 4BP
Silk thread Gütermann S 303, Col. 802	John Lewis, Oxford Street

Wellcome Institute No.: Tibetan 38

Description

Object:	Bound book
Title:	Official record of tribute paid to Lhasa by the Phari district during a series of years.
Author:	Unknown
Date:	"2nd day of 9th month of the iron
male	horse year" 1870
Provenance:	Phari district, Tibet

Description of object

Dimensions:	Cover 104 x 226 mm. Text block 104 x 226 mm
Characteristics:	Manuscript, written in black ink with different coloured strokes in water colour above the writing on recto and verso. Four lines to a page in dbu-med. 32 folios are blank.
Number of folios:	91
Pagination:	In Tibetan on recto top left hand side.

Description of paper

Characteristics:	Handmade. Wove with laid lines (imprint of bamboo mould). Some deckle edges. Single-layered.
Thickness:	0,09 - 0,22 mm
Coated:	No
Tone:	Yellowish
Surface texture:	Smooth

Description of book

Binding:	Full bound
Book make up:	Five gatherings
Covering material:	Limp cover
Title:	Fragment, written in Tibetan on paper and stuck on the front cover on top left hand side. Written in English on paper and stuck on the front cover on bottom right hand corner. Tibetan sign written in black ink on back cover in the centre. Library mark written on paper and stuck on back cover on top left hand corner.

Description of structural make up

End papers:	None
Sewing:	With two threads in cattle stiches.
Text block shape:	The book is folded and bound at the head, which is the longer side.
Covering material:	Undyed cloth
Cover attachment:	The cloth is stuck on the first page of the first gathering, or the last page of the last gathering.
Other:	Every gathering has a cloth joint at the outer double page. There is a twisted thread attached to the sewing to hold the book together.

Condition

The cloth covers were badly damaged and floppy. Therefore the inside papers were exposed to deterioration. The inside paper lining were partly detatched and torn. Two pages were missing. All pages had numerous tears at the edges and in the folds. The first gathering was heavily creased and had missing areas. The sewing was cut apart from the last gathering. Generaly the whole book was covered in heavy black dust and had black greasy edges from fingerprints mainly at the right hand bottom side.

Test Record

pH Record: 5.8; 6.0; 6.9; 7.0

Fibre Furnish:

book cover: Cotton
paper: Thymelaeaceae

Spot Testing:

Lignin:	negative
Alum:	negative
Starch:	positive
Rosin:	negative
Arsenic:	positive

Fugitivity Tests:

		H_2O dest.	IMS	IMS / H_2O 50%/50%
ink		+	-	+
pigments	pink	+	-	+
	brown	+	+	+
	red	+	-	-
	black	+	-	-
	yellow	+	+	+
	green	+	-	-
	blue	+	-	-

Pigment Identification:

Yellow	orpiment
Red	vermillion (but there are other organic ones)
Brown	organic colour

Treatment

MATERIAL USED	TREATMENT
Brush	Brushed the paper and book cloth in the fume hood.
	Pulled the sewing threads.
Distilled water	Spray relaxed the paper and cloth. At the same time removed cloth cover and cloth joints from the paper.
Paper tissue TP1 from Thailand Rice starch 10% w/v	Repaired the paper tears.
Distilled water	Washed the cotton cloth cover and joints on acid free blotter and suction table.
100% linen cloth, boiled and washed	Cut in shape smaller then the original cover cloth. Frayed the edges, so that the lined infolds would not fold 8 times.
Linen cloth Rice starch 10% w /v	Backed the original cloth with linen on the suction table.
18th century Tibetan or Nepali paper Rice starch 10% w/v	Filled in two missing pages.
Paper H5 from Nepal Rice starch 10% w/v	Filled in small missing areas on both sides.
Rice starch 10% w/v	Pasted the washed and consolidated cloth cover and joints back to the paper.
Pageing cord	Resewed the book by using the original sewing holes.

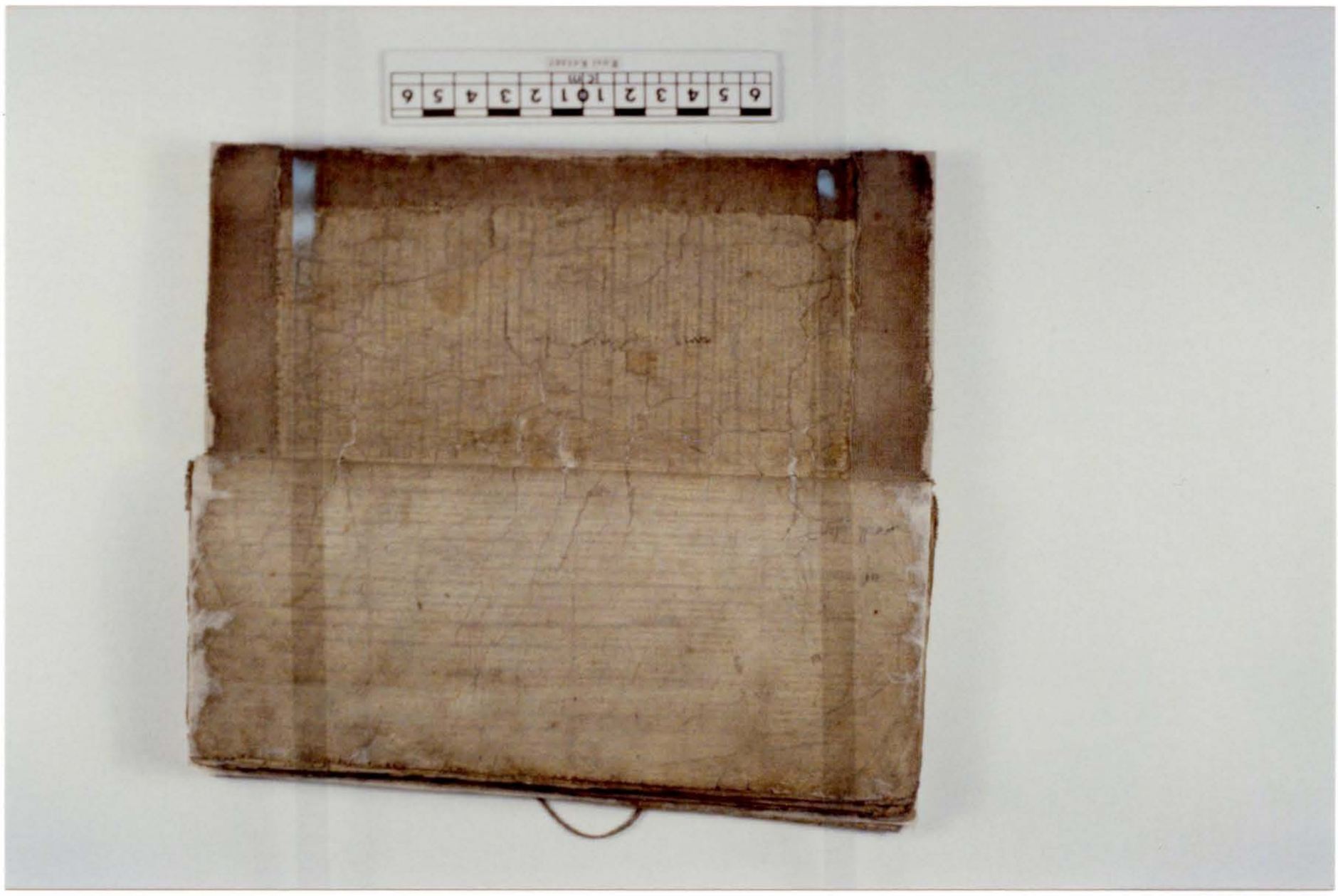
Material Used	Suppliers
Paper H5 Thin off white handmade Daphne paper from Nepal	Khadi Papers, Childgrove, Chichester PO18 9HU
Paper TP1 Thin handmade Mulberry tissue from Thailand, pH 8.0	Khadi Papers, Childgrove, Chichester PO18 9HU
18th century Nepalese or Tibetan paper. Mulberry und Daphne	Peter Bower, 64 Nutbrook Street, London SE15 4LE
Rice starch Prod. 30263 / 9896410F	BDH Chemicals Ltd. Poole England
100% Linen cloth boiled and washed	Kindly obtained from: The Conservation Centre, Hampton Court Palace
Pageing cord 100% hemp	Printers supply

For the conservation of this book I was awarded the 3rd price form the Riley Dunn And Wilson Conservation Competition 1993 administered by the National Preservation Office at the British Library.

No.43 Wellcome Institute No.38 Front cover after treatment.

No.44 Wellcome Institute No.38 Back cover after treatment.

No.45 Wellcome Institute No.38 Inside of front cover after treatment.



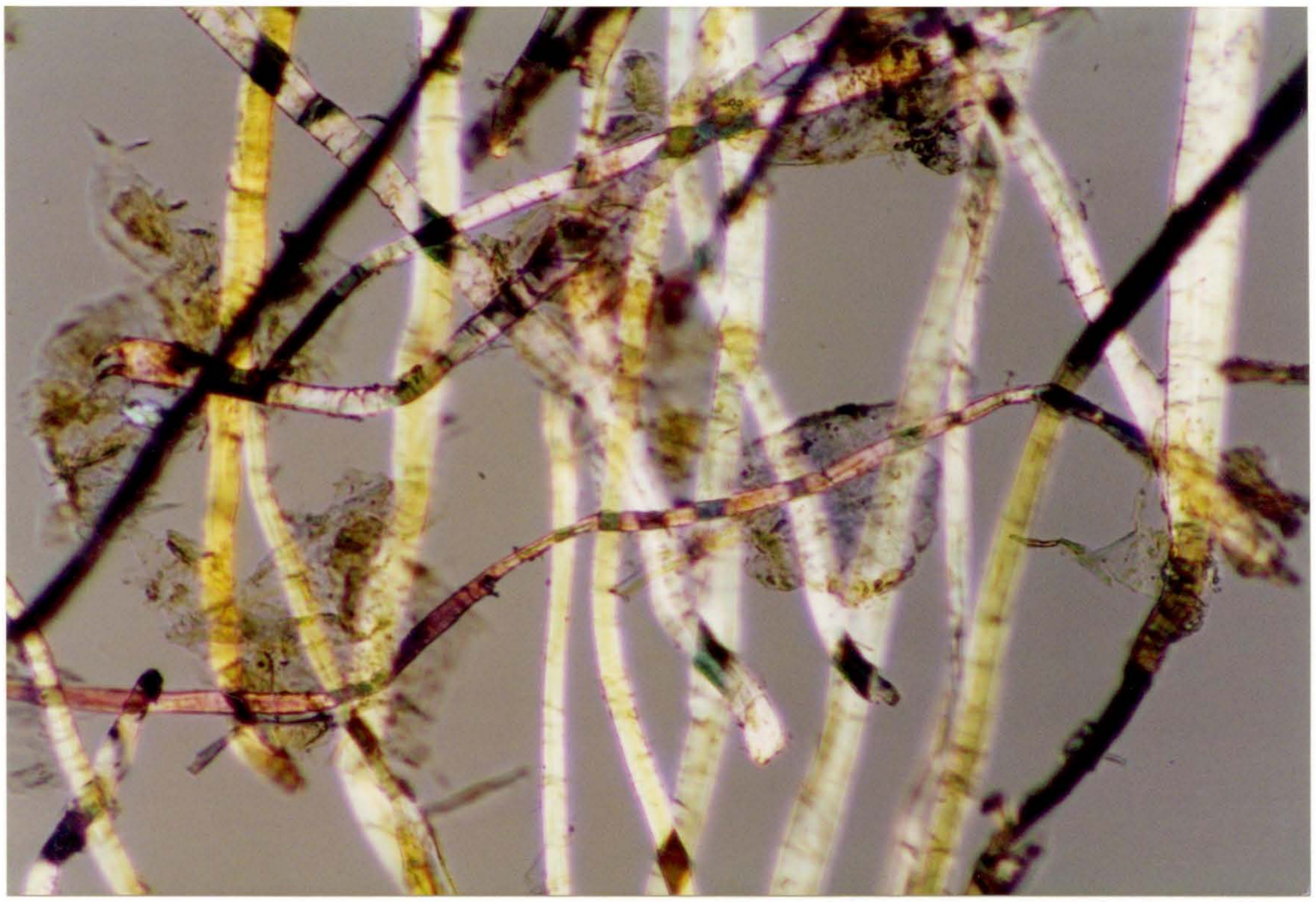
No.46 Wellcome Institute No.38 Inside of back cover after treatment.

No.47 Wellcome Institute No.38 Text block after treatment.

No.48 Wellcome Institute No.38 Text block after treatment.

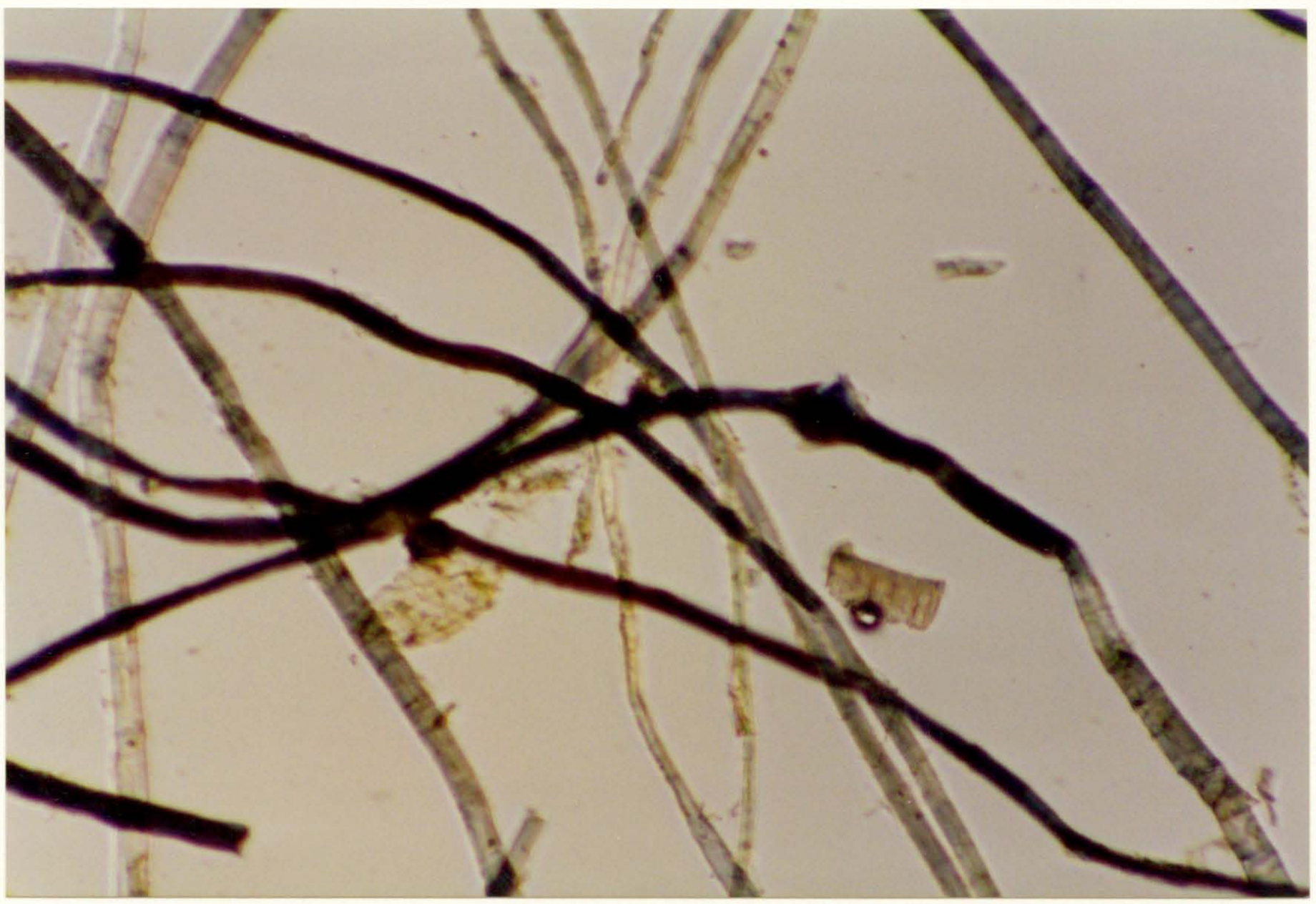
Appendix III

Foto Documentation of Fibre Analysis



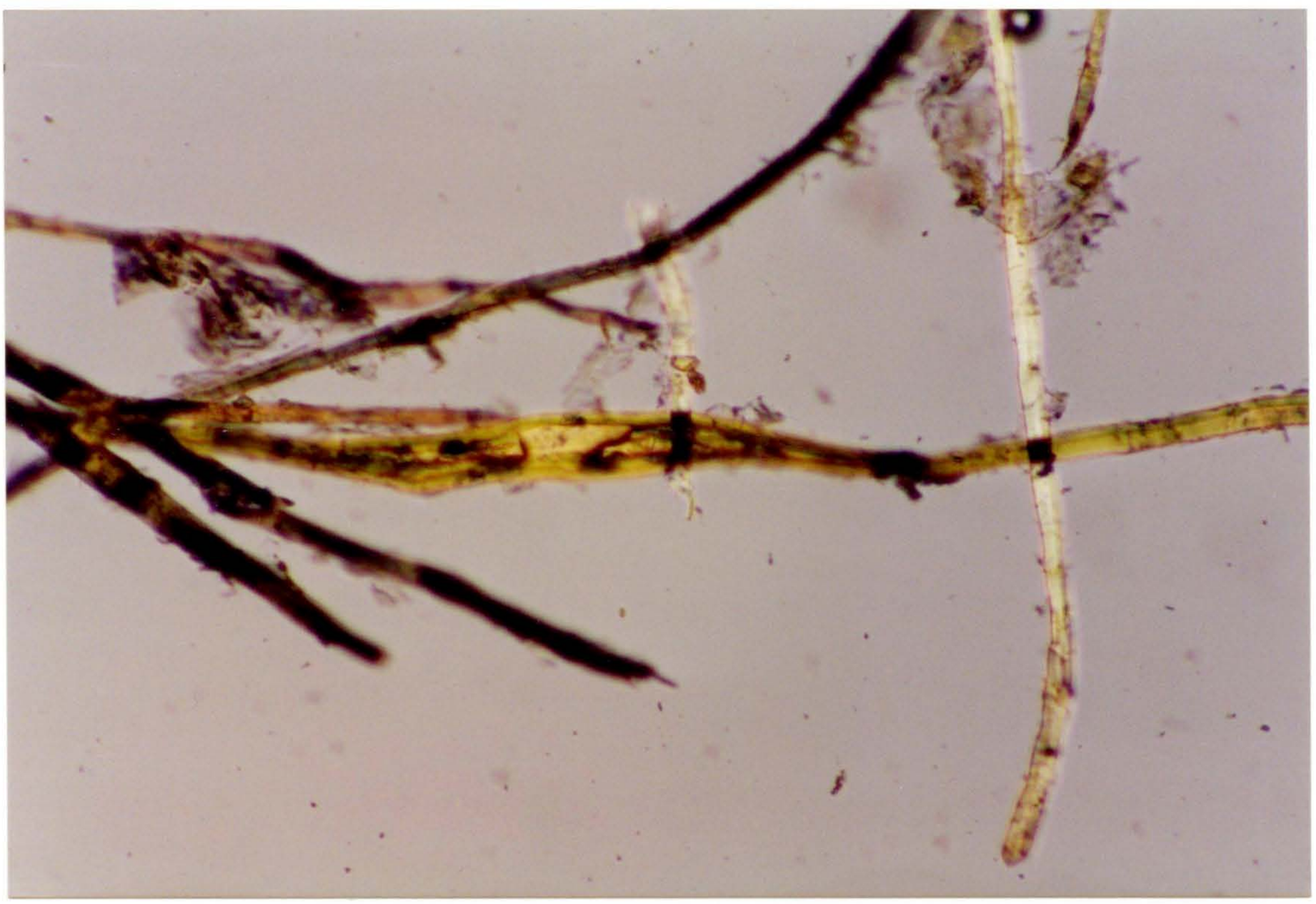
No.49 H.M. NN 1697 Thymelaeaceae 100x 180° polariser angle.

No.50 H.M. 1696 Hemp & Thymelaeaceae 100x 150° polariser angle.

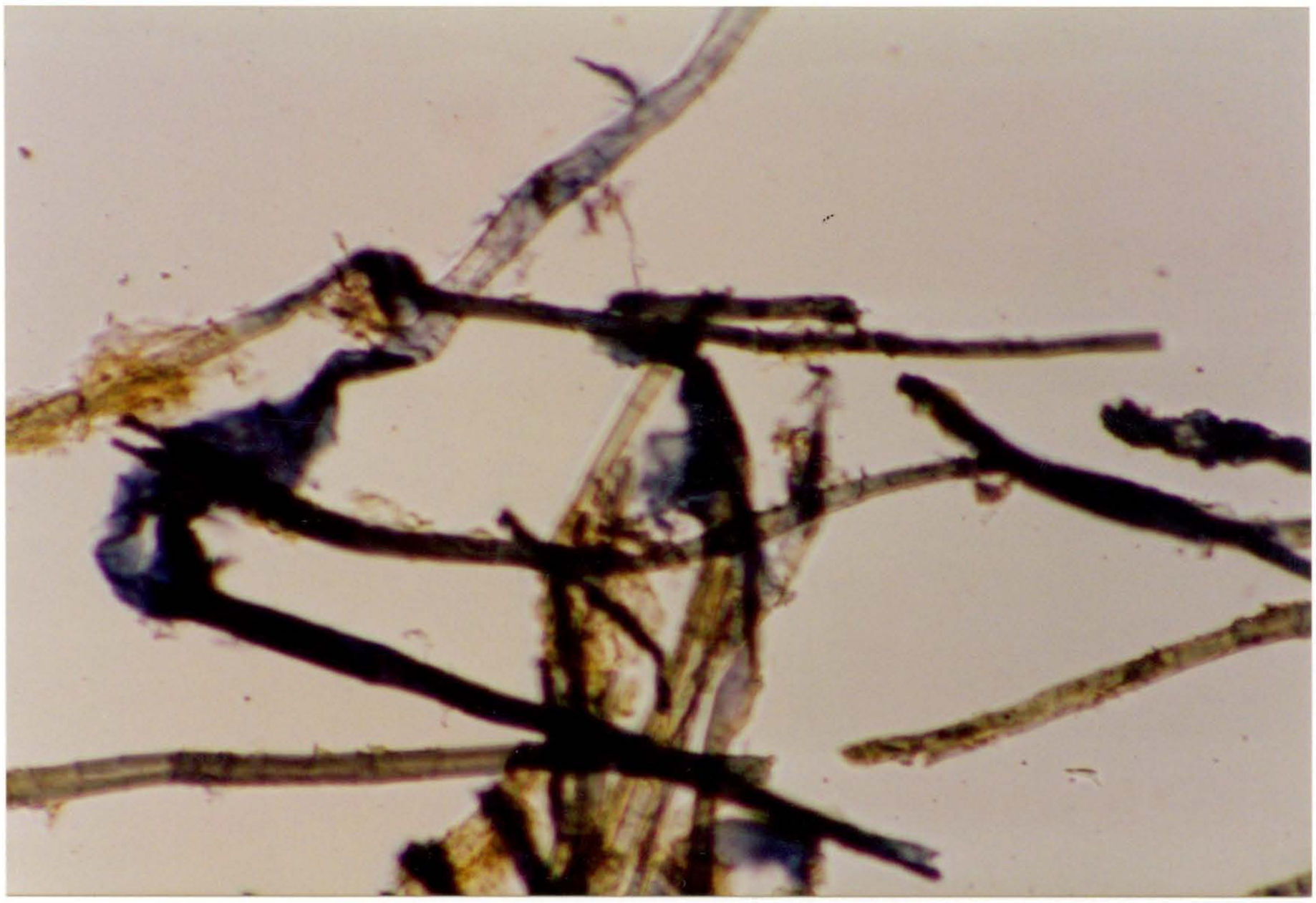


No.51 H.M. 6.12.65/65 Thymelaeaceae 100x 150° polariser angle.

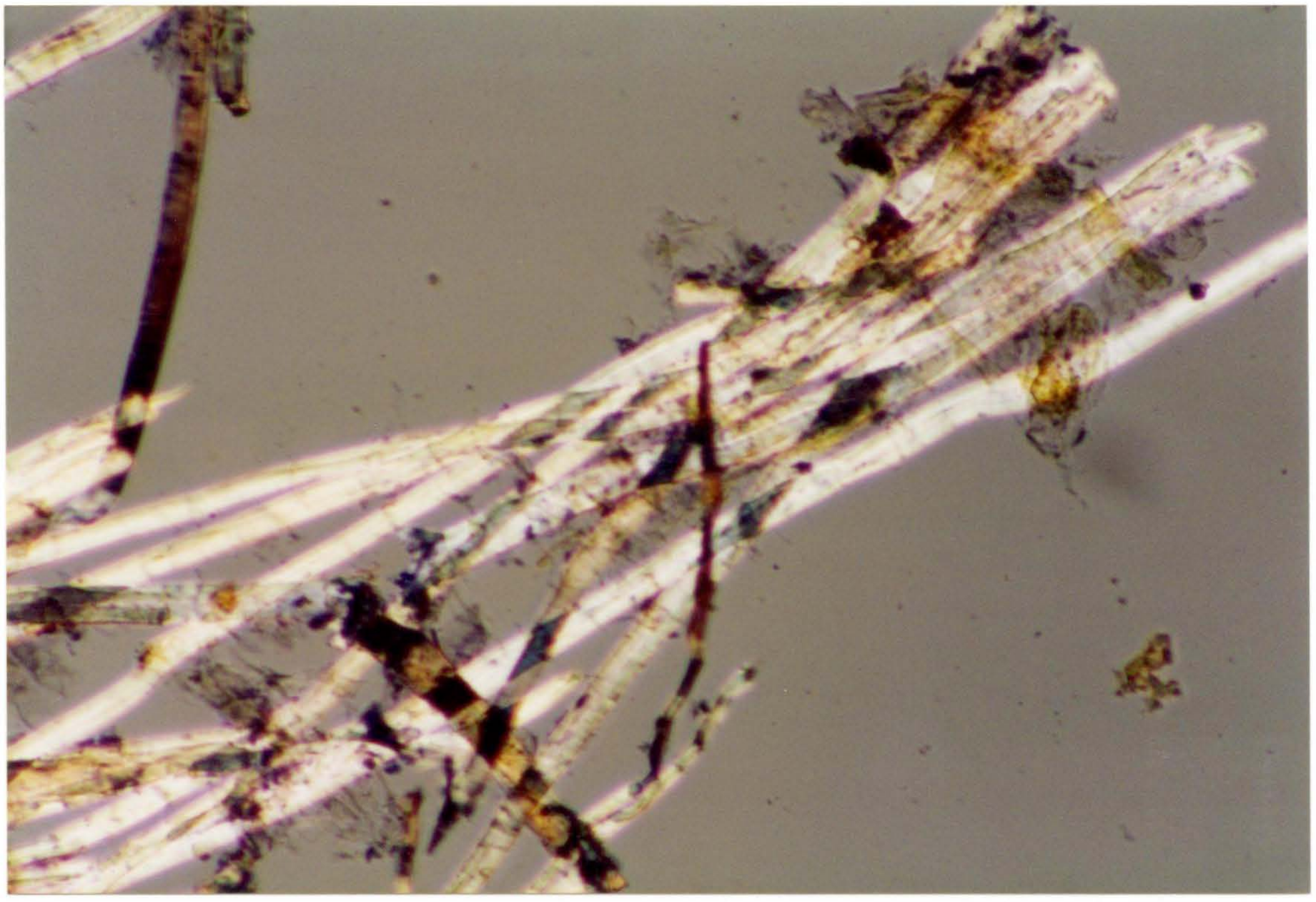
No.52 R.A.S. 5 pp.1-6 Chinagras & Paper mulberry 100x 168° polariser angle.



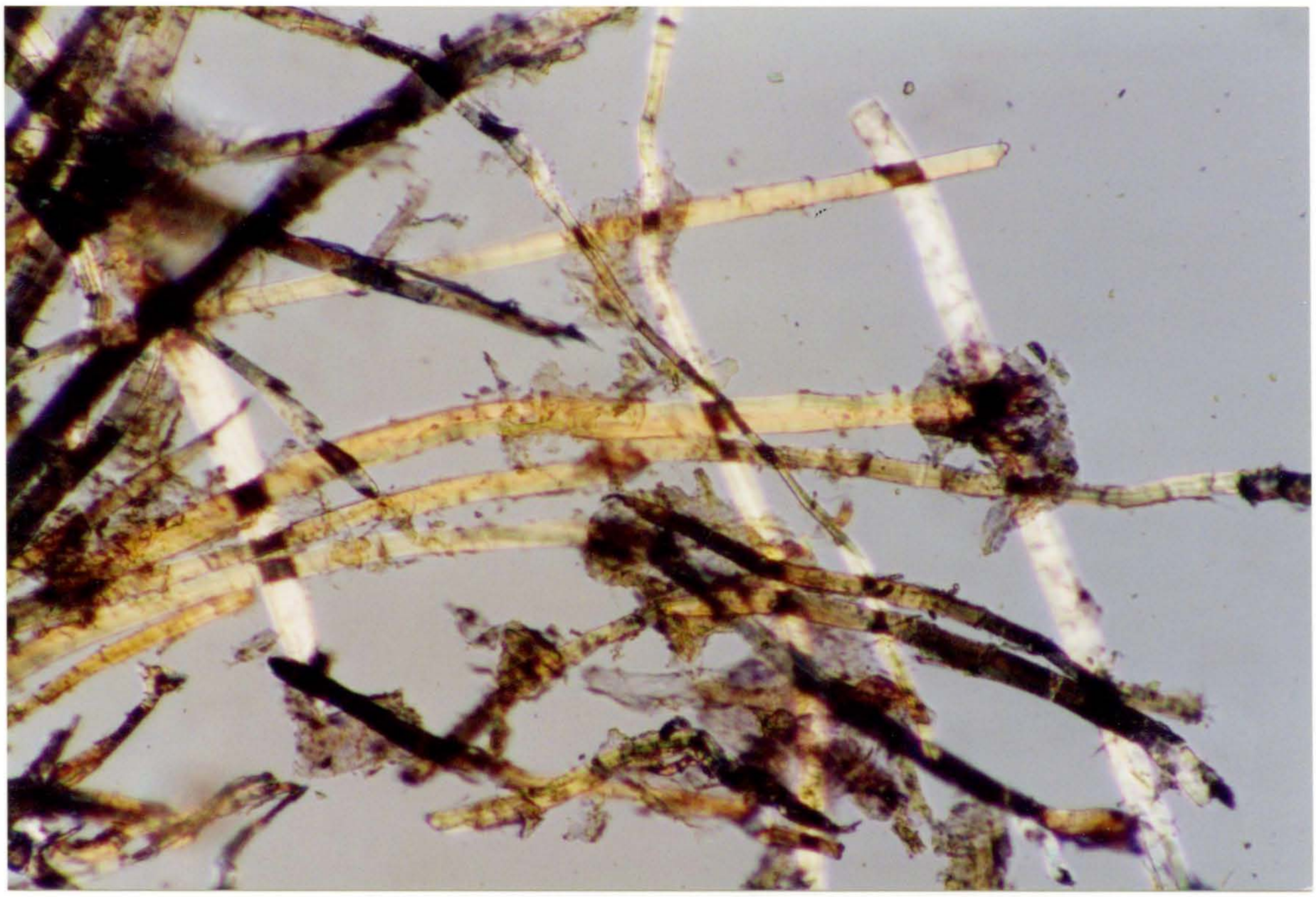
No.53 R.A.S. 5 pp.7-17 Thymelaeaceae 100x 170°polariser angle.



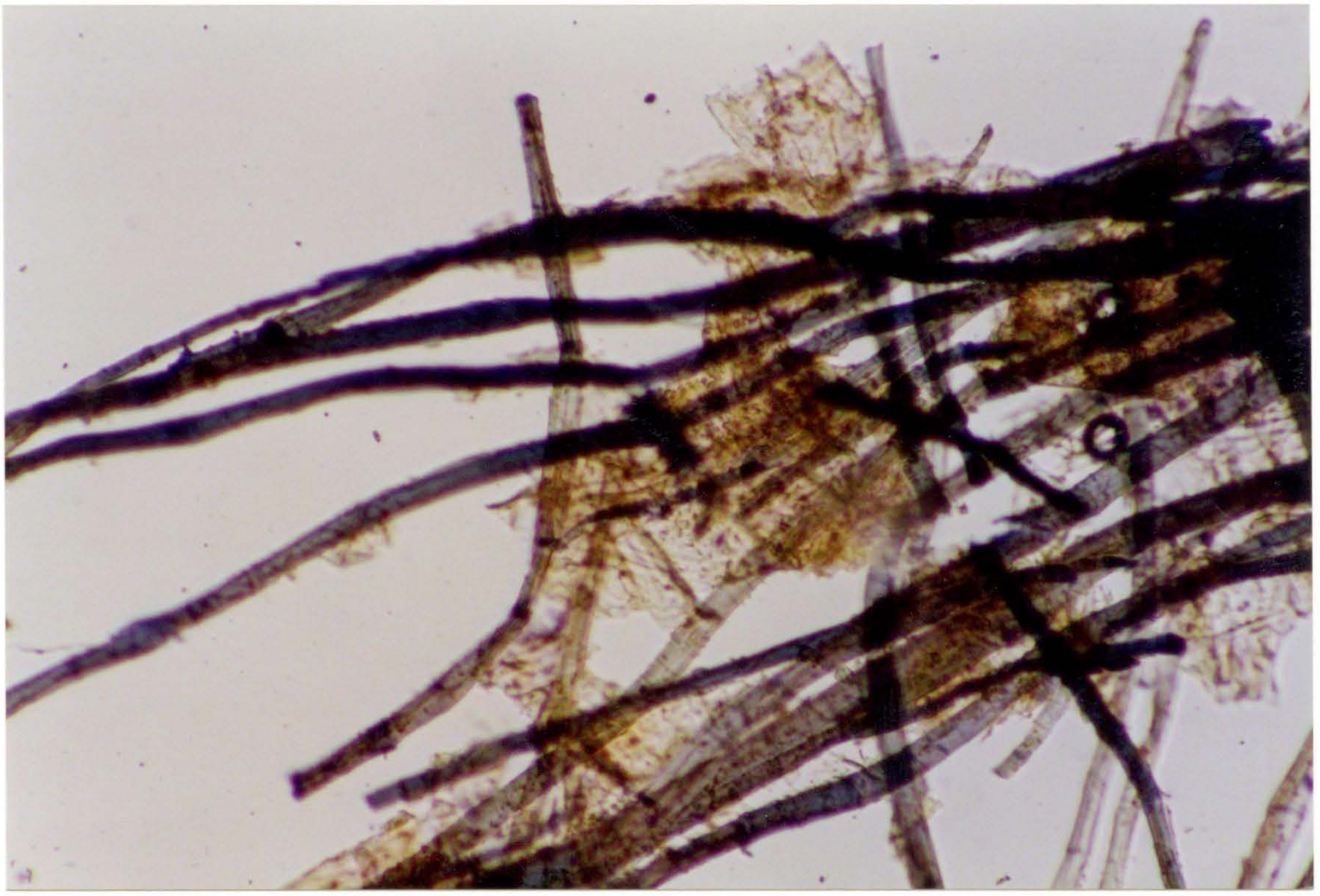
No.54 R.A.S. 5 pp.18-26 Cotton & Thymelaeaceae 100x 62° polariser angle.



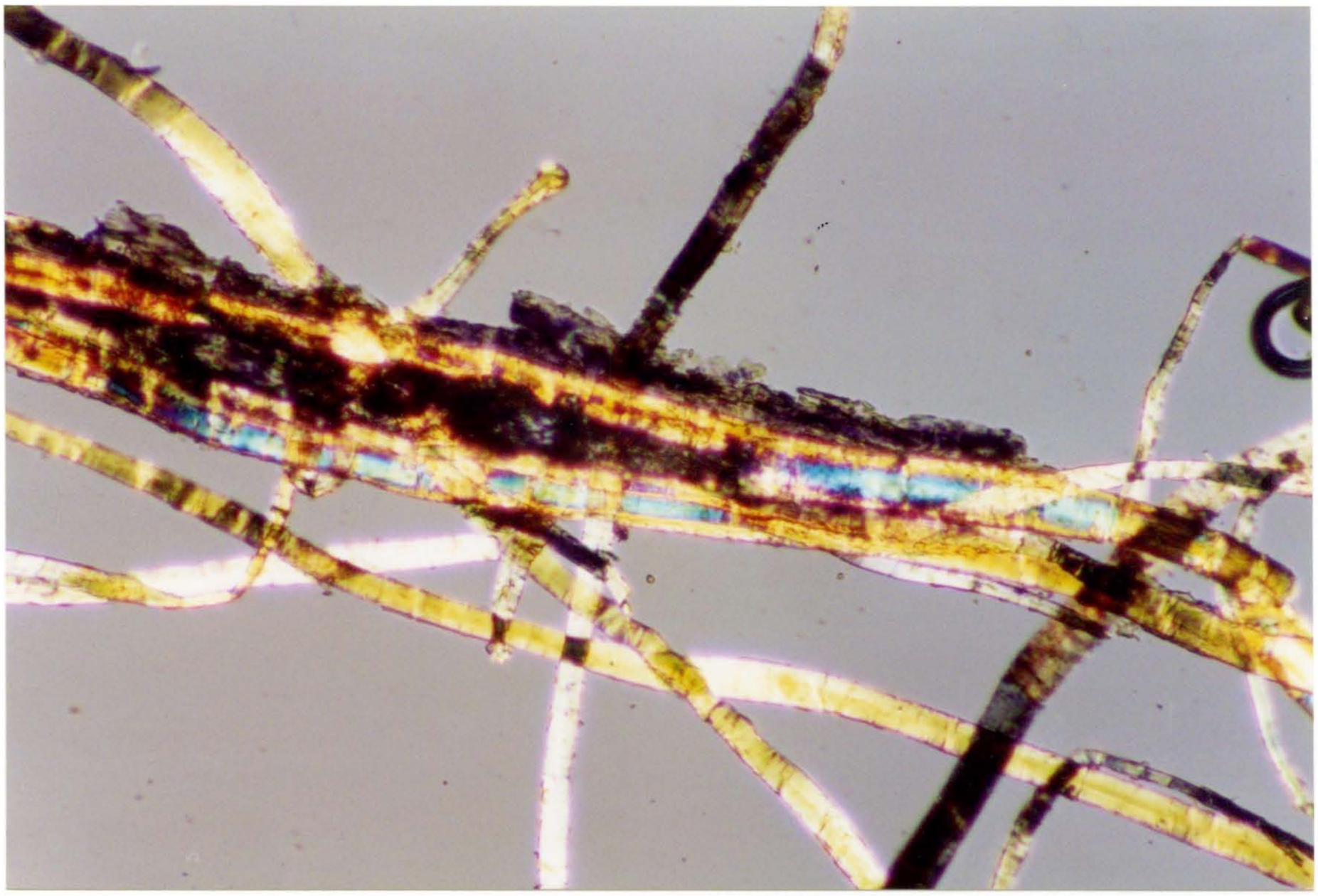
No.55 R.A.S. 5 pp.27-29 Thymelaeaceae 100X 19° polariser angle.



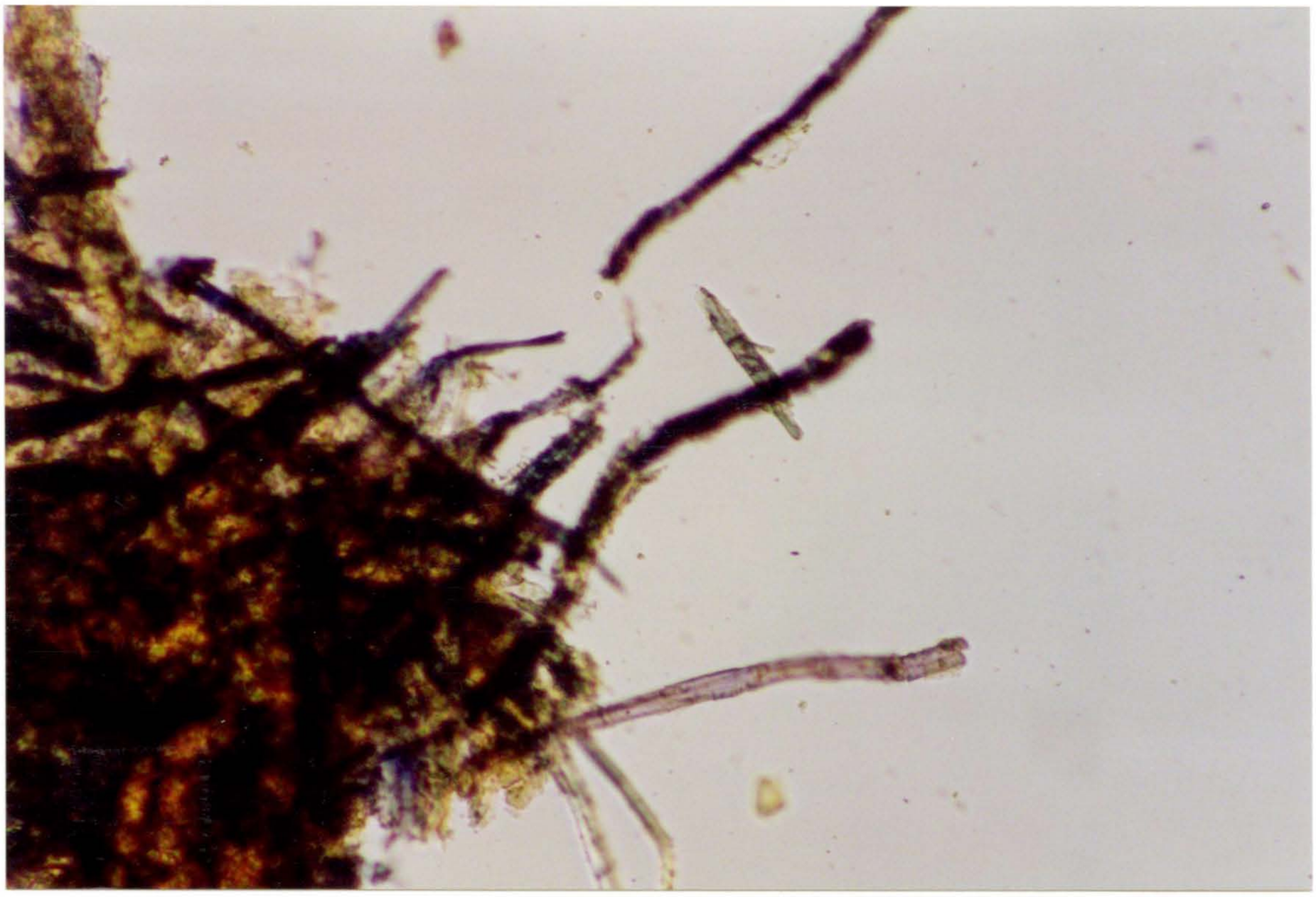
No.56 R.A.S. 5 pp.30-37 Hemp & Paper mulberry 100x 176° polariser angle.



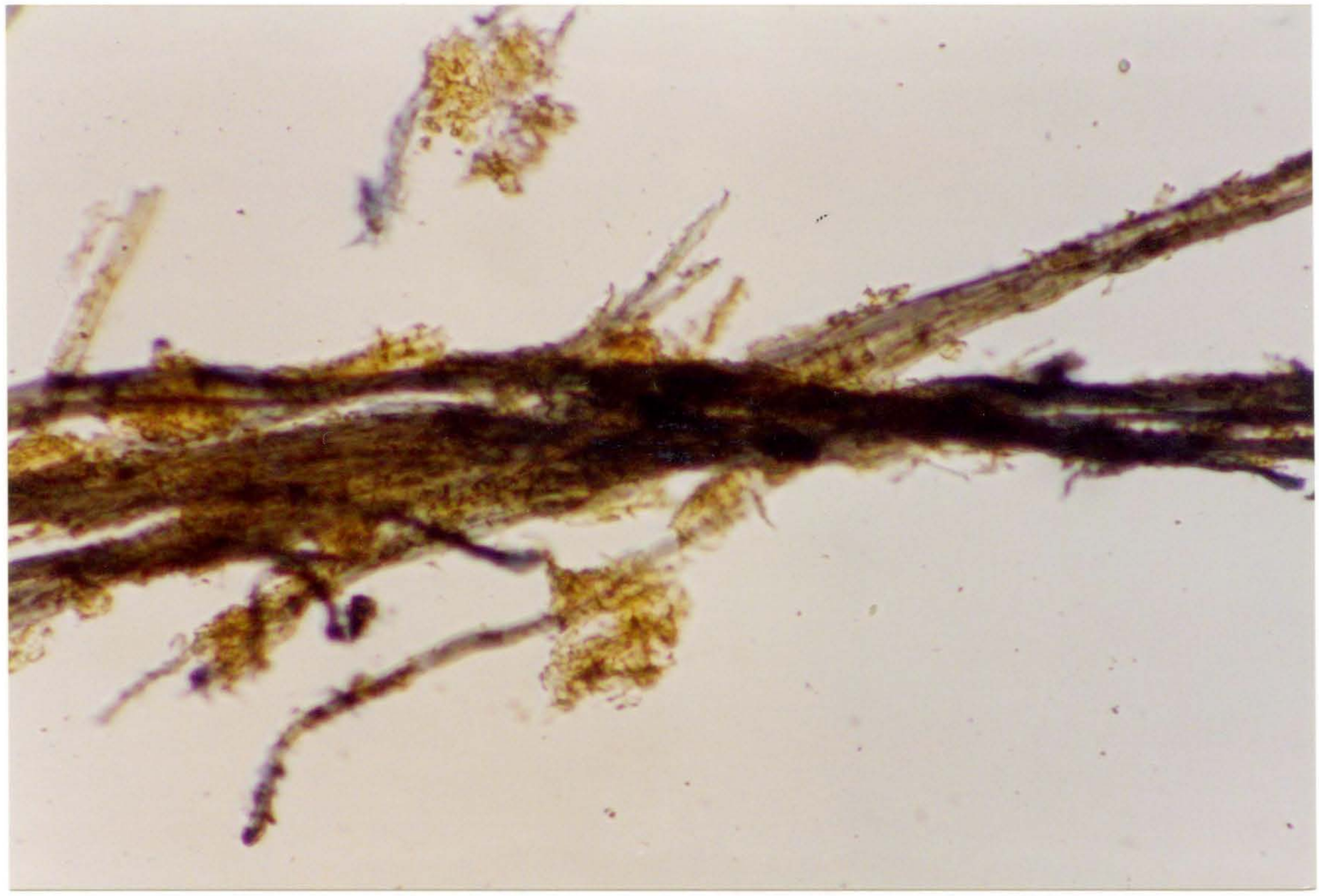
No.57 R.A.S. 5 pp.38-39 Thymelaeaceae 100x 110° polariser angle.



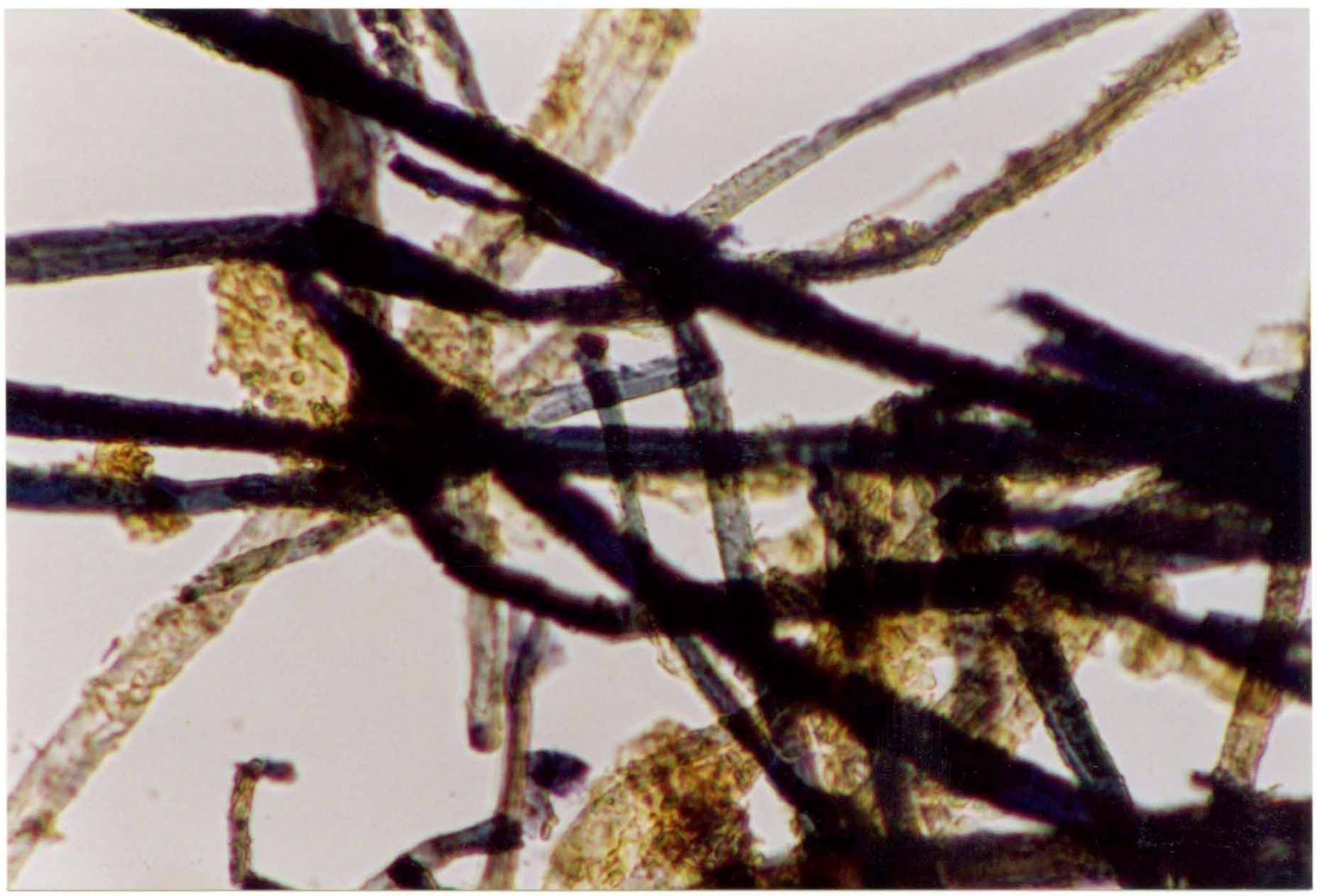
No.58 R.A.S. 5 p.40 Paper mulberry & Thymelaeaceae 100x 180° polariser angle.



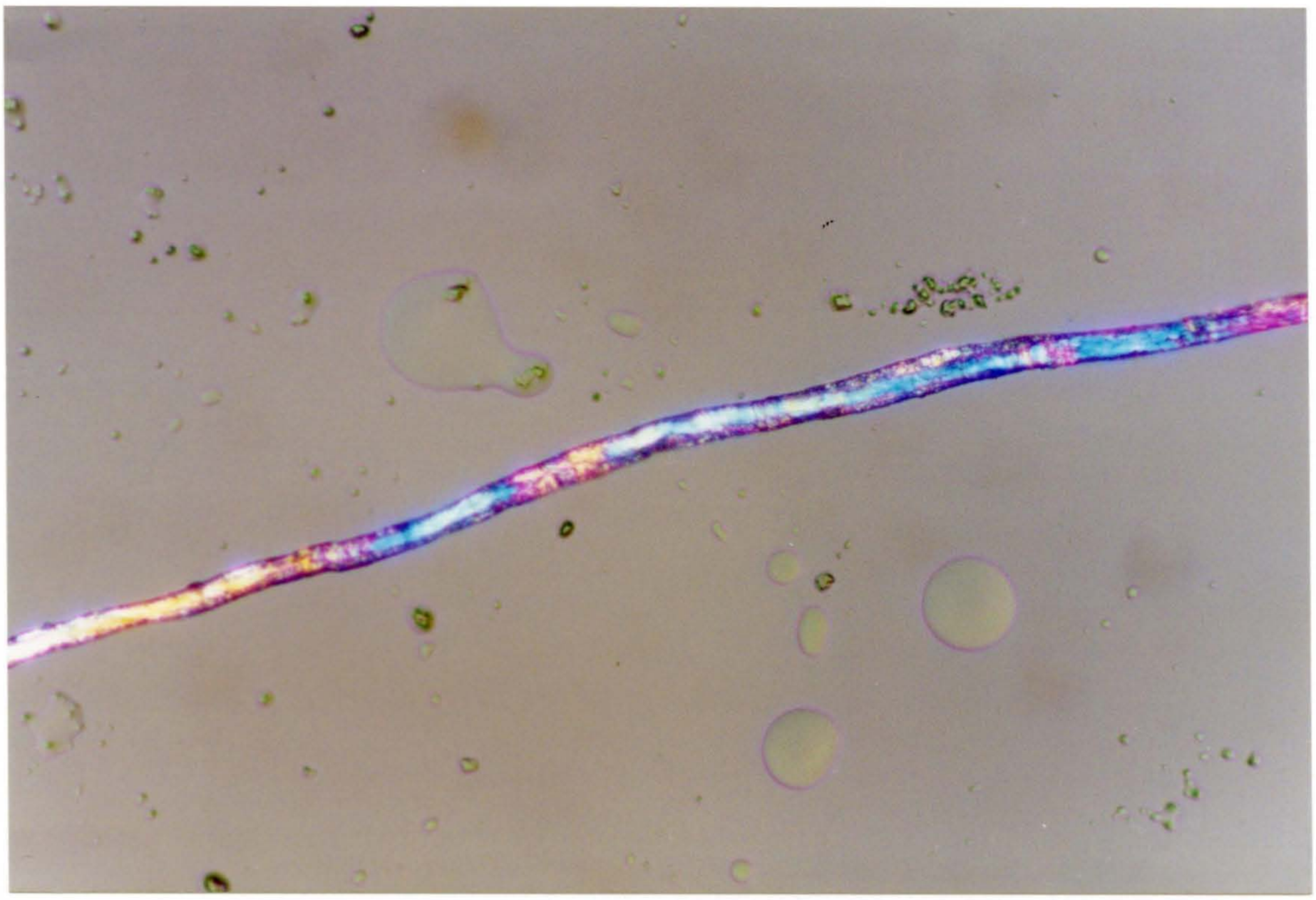
No.59 R.A.S. 5 p.41 Thymelaeaceae 100x 156° polariser angle.



No.60 R.A.S. 5 p.42 Thymelaeaceae 100x 79° polariser angle.

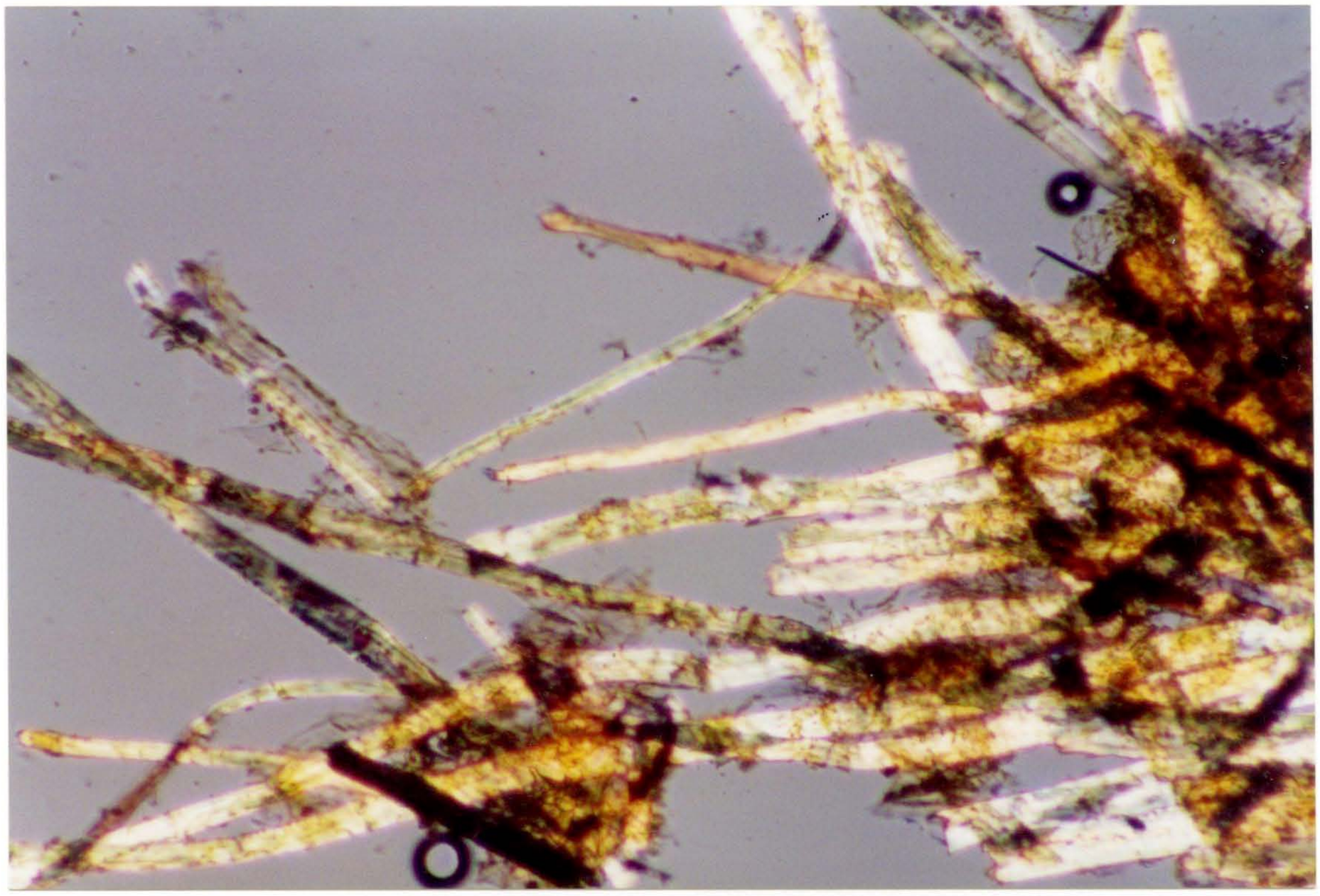


No.61 R.A.S. 5 pp.43-44 Thymelaeaceae 200x 92° polariser angle.



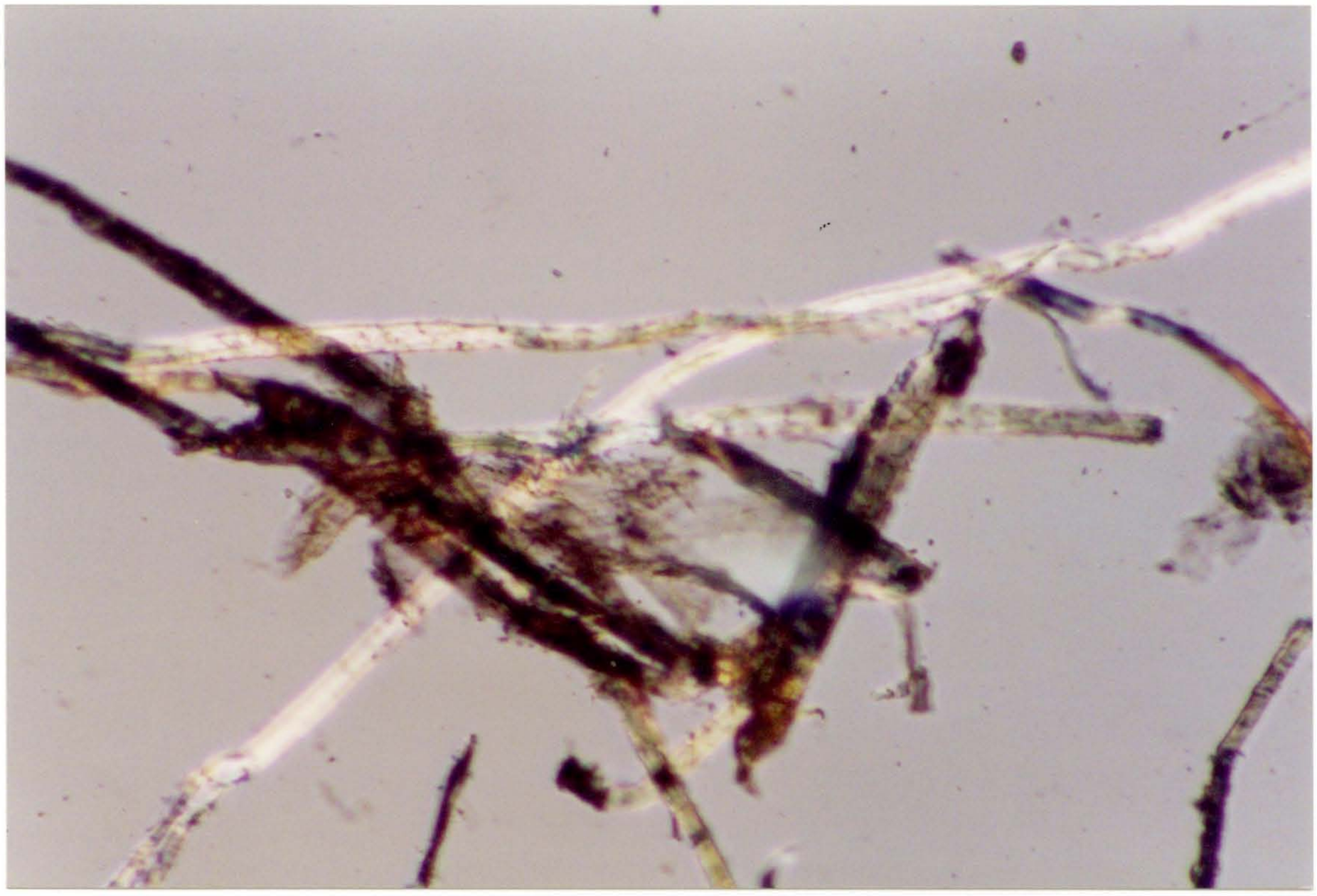
No.62 R.A.S. 5 pp.45-46 Paper mulberry & Thymelaeaceae 100x 179° polariser angle.

No.63 R.A.S. 5 p.47 Thymelaeaceae 100x 178° polariser angle.

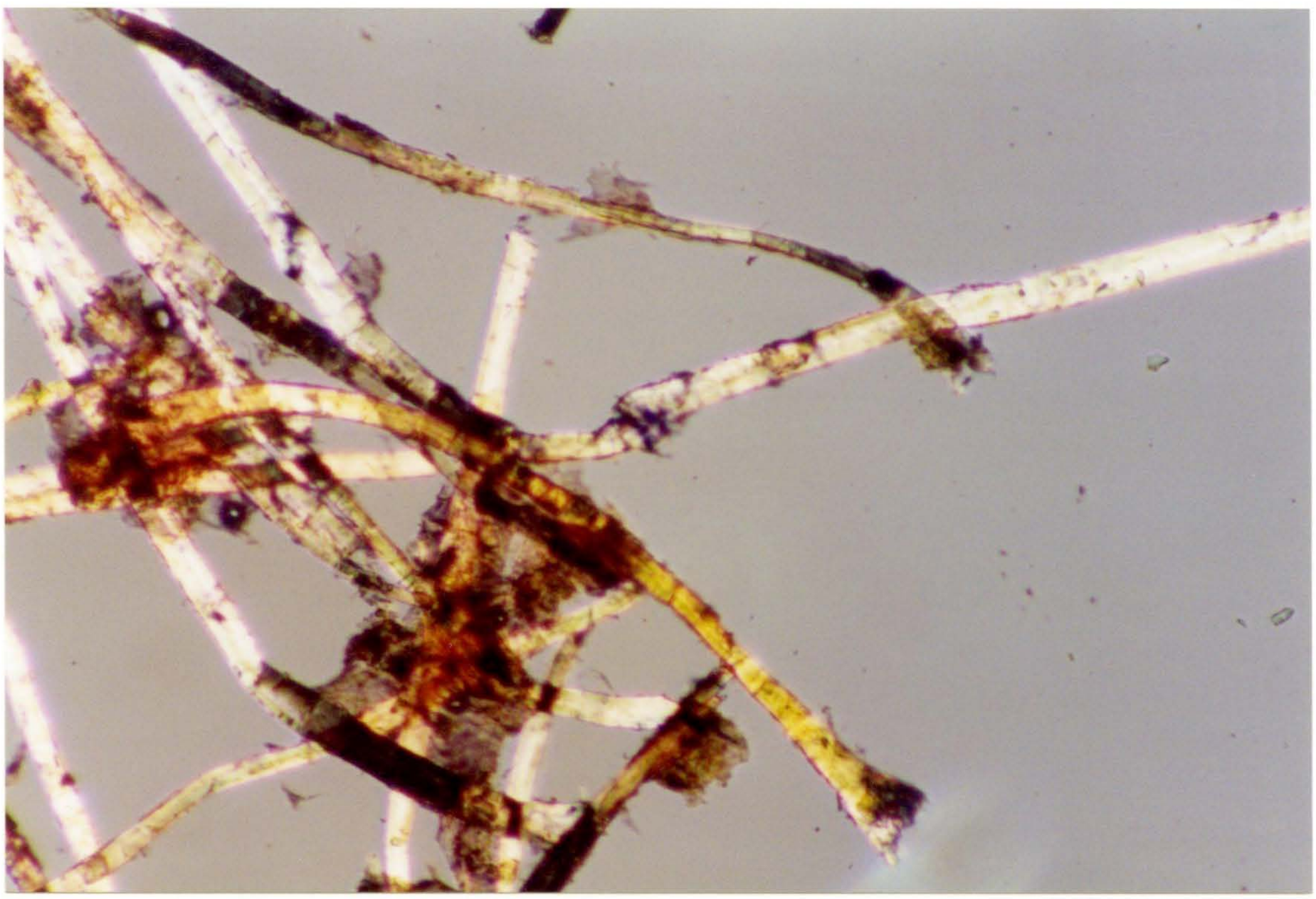


No.64 R.A.S. 5 p.48 Thymelaeaceae 100x 180° polariser angle.

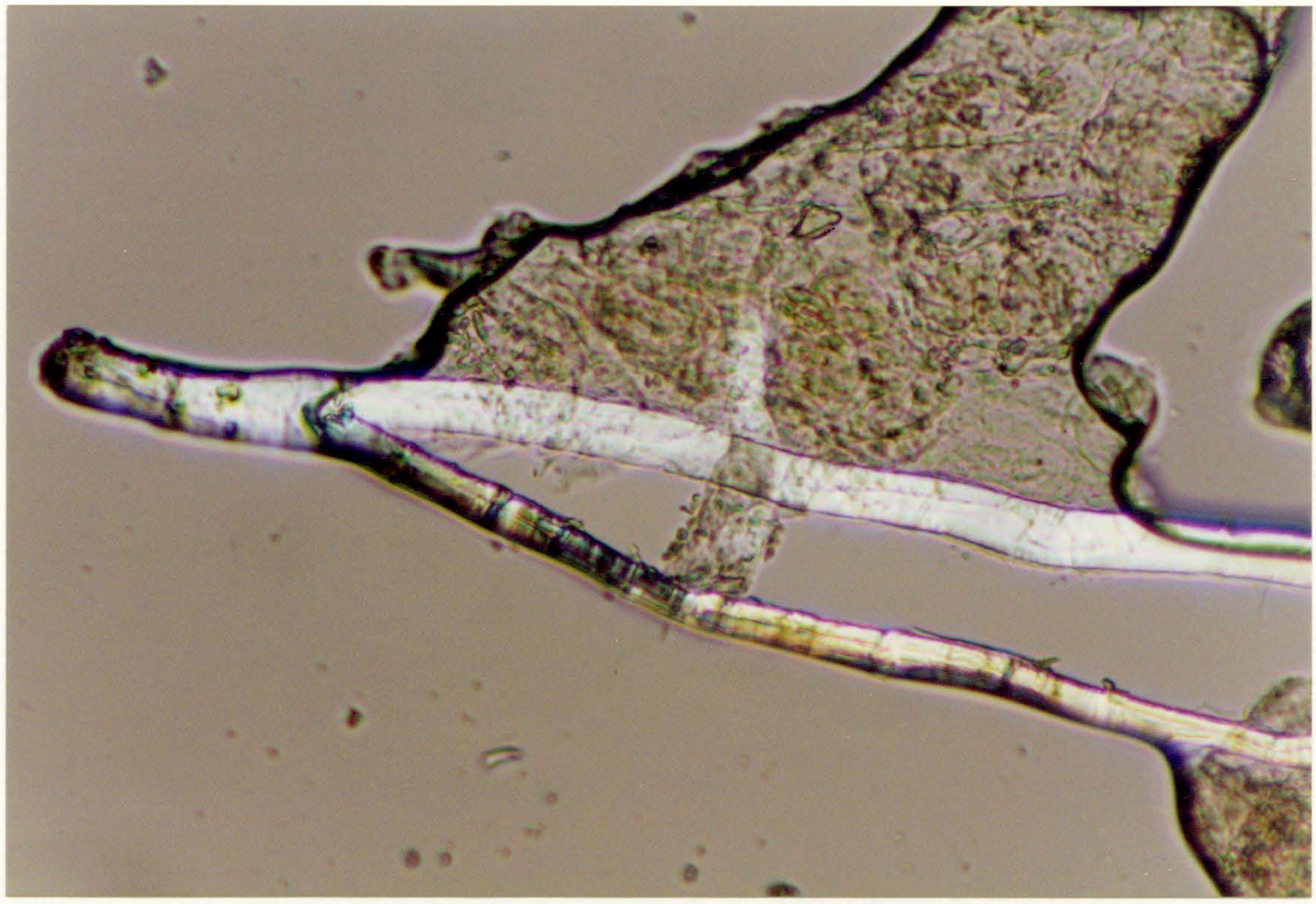
No.65 R.A.S. 5 pp.49-56 Cotton & Thymelaeaceae 100x 2° polariser angle.



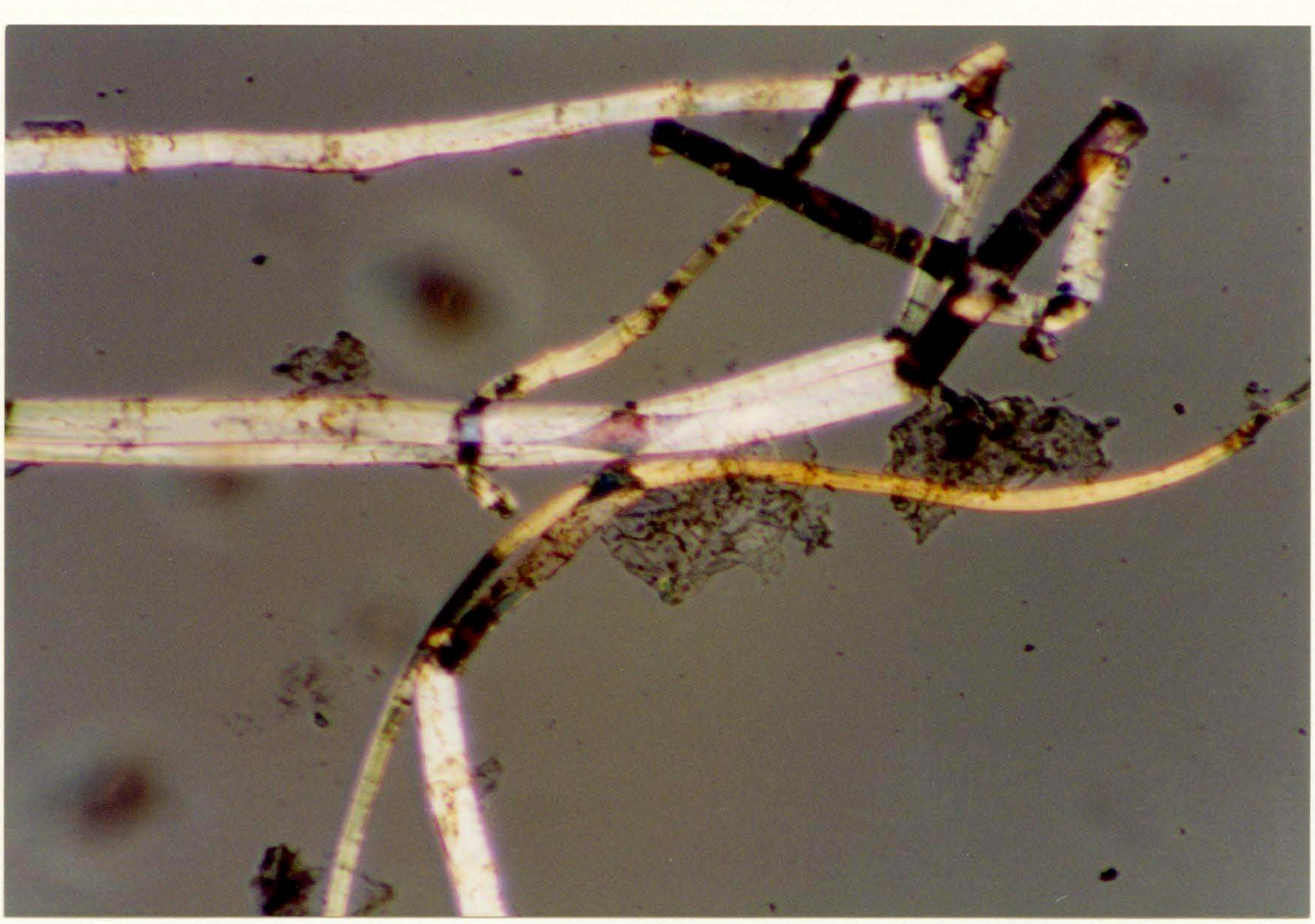
No.66 R.A.S. 5 p.57 Thymelaeaceae 100x 21° polariser angle.



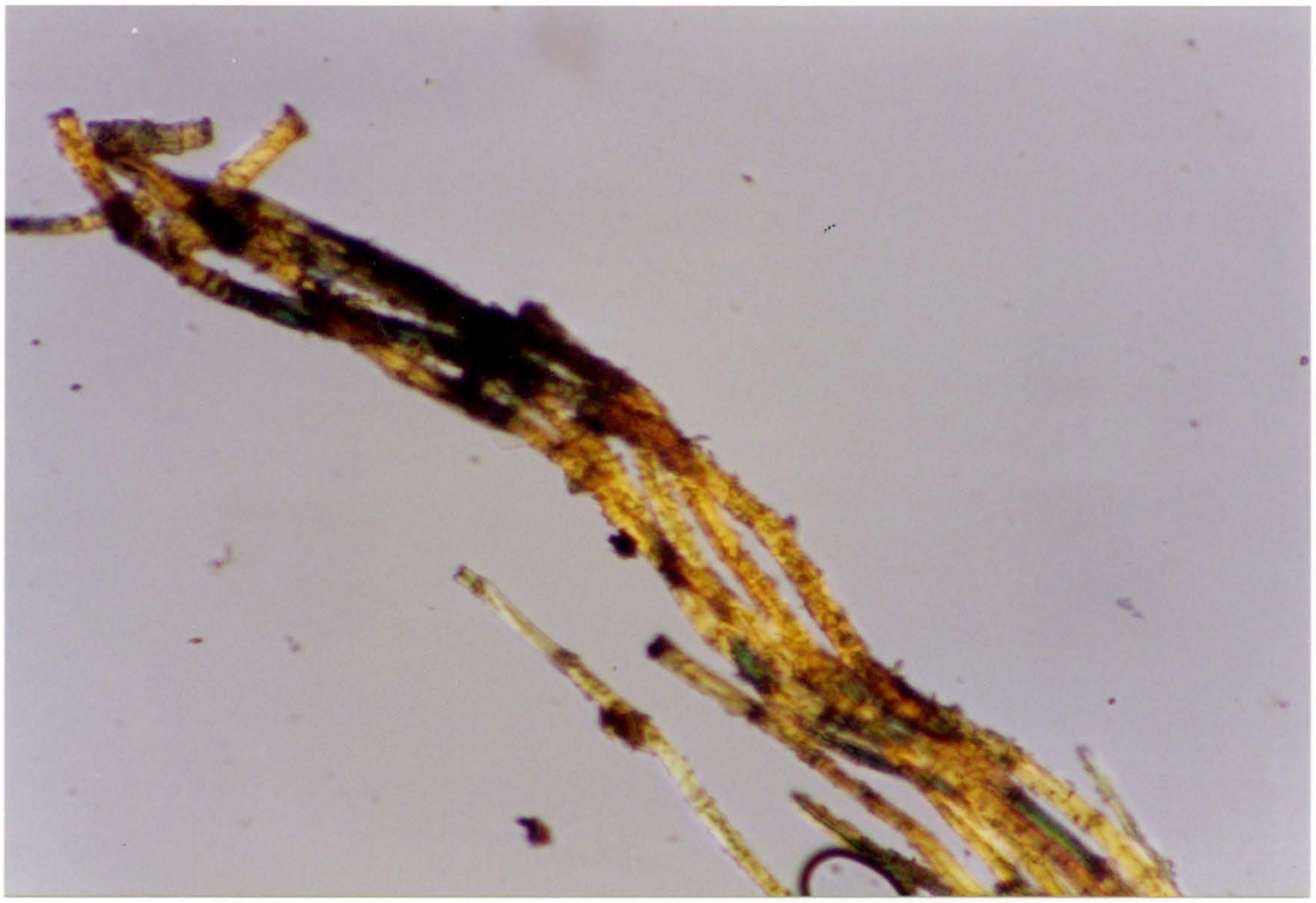
No.67 R.A.S. 5 p.58 Thymelaeaceae 100x 180° polariser angle.



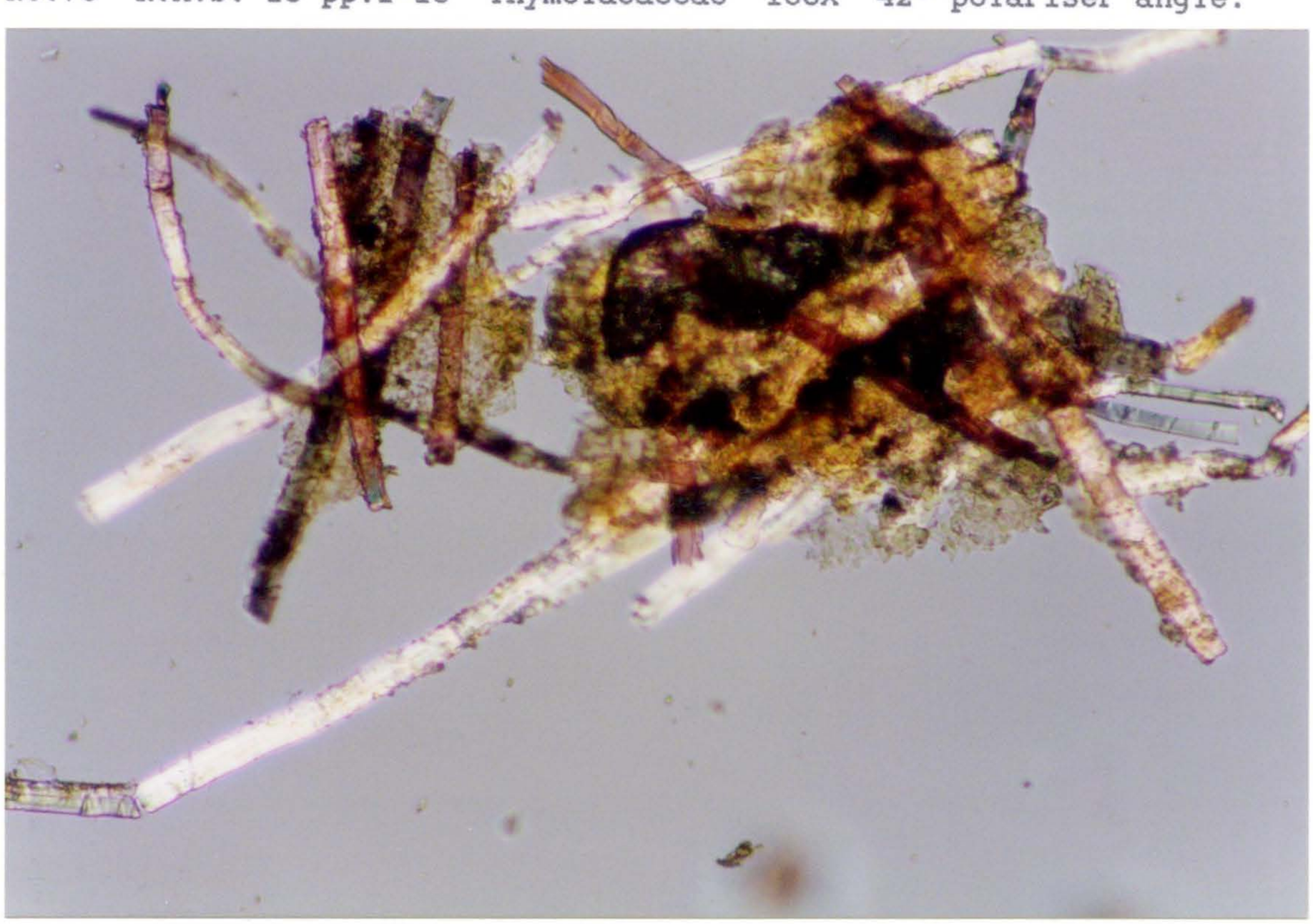
No.68 R.A.S. 7 Thymelaeaceae 200x 168° polariser angle.



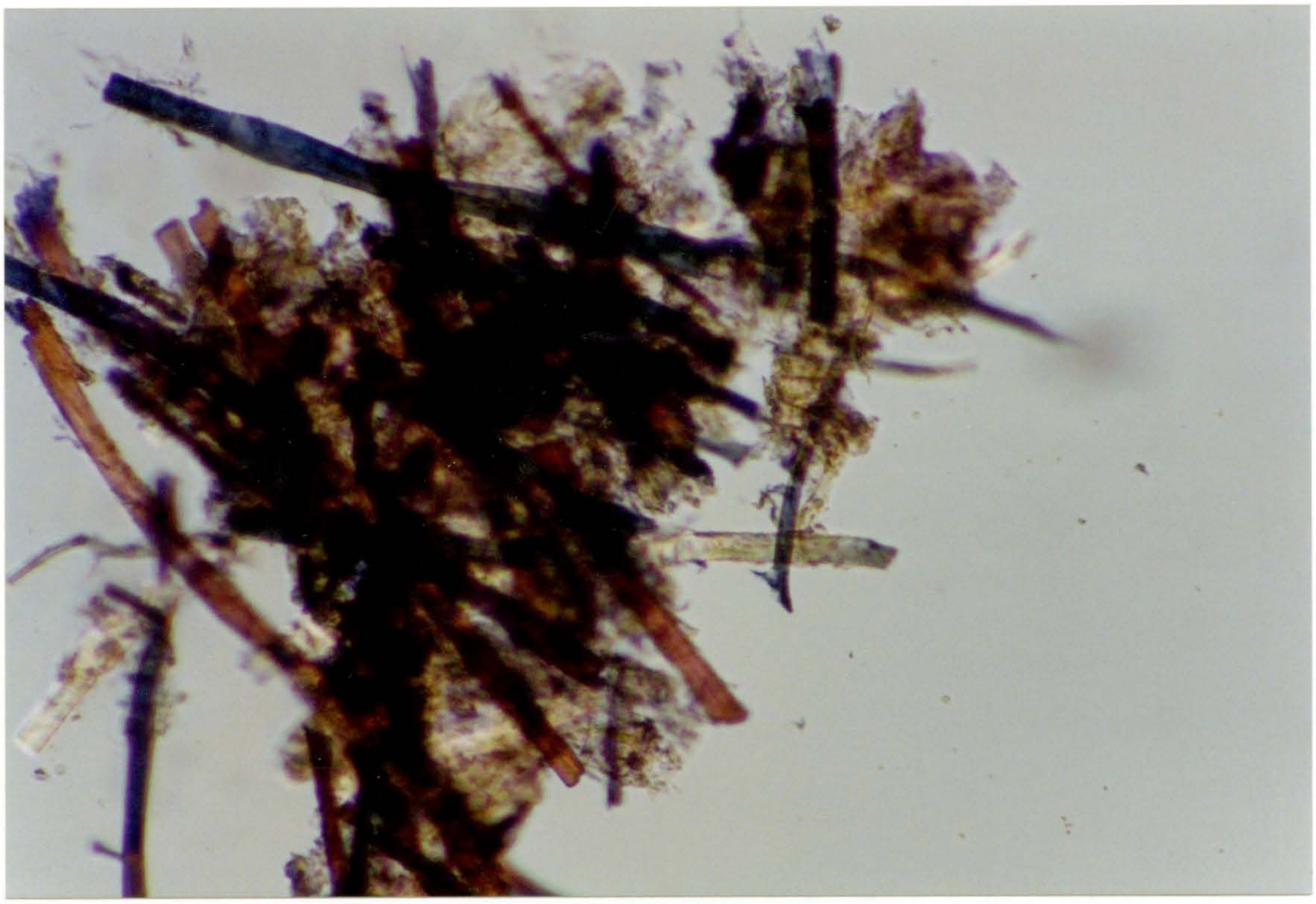
No.69 R.A.S. 12 Thymelaeaceae 100x 1° polariser angle.



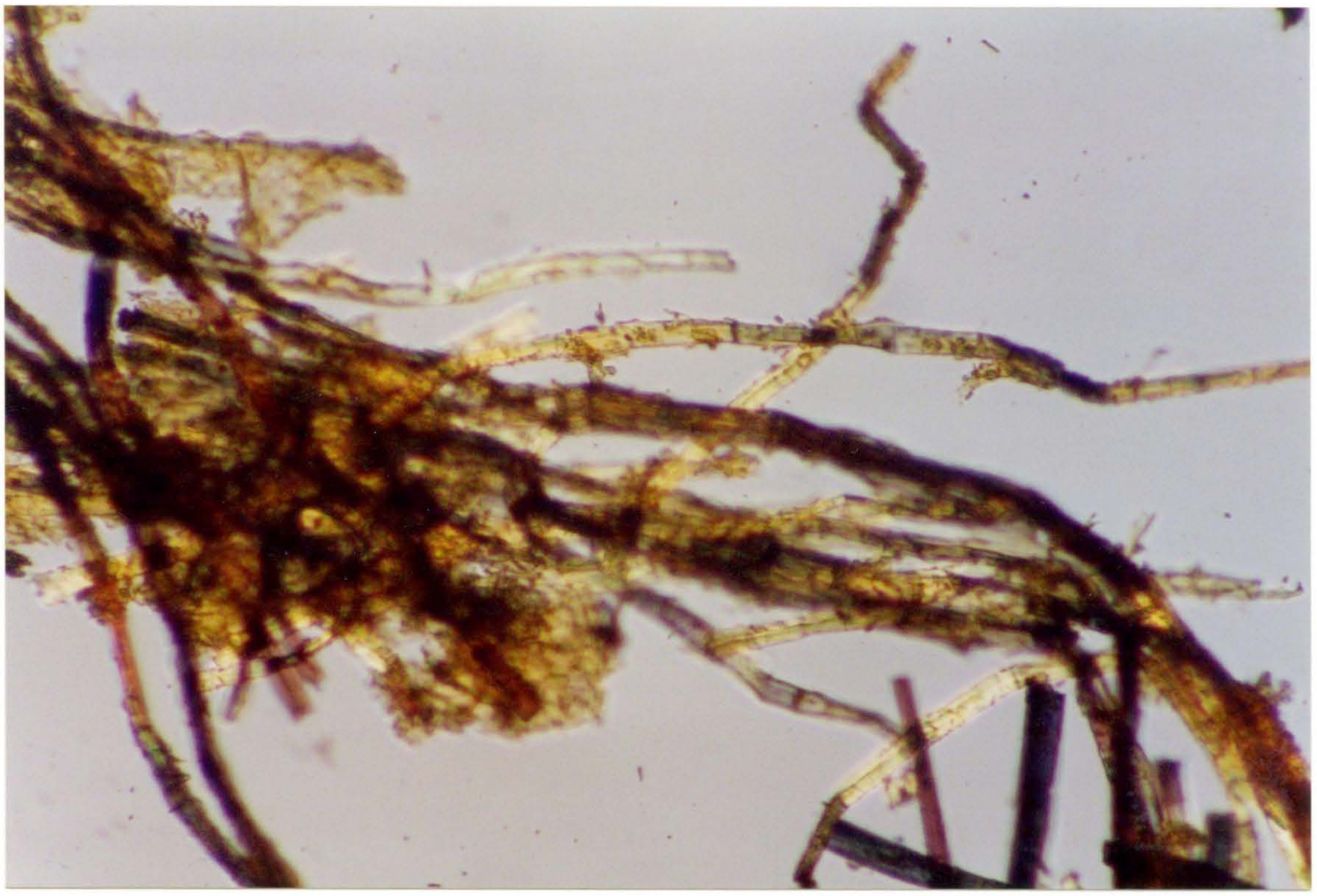
No.70 R.A.S. 13 pp.1-13 Thymelaeaceae 100x 42° polariser angle.



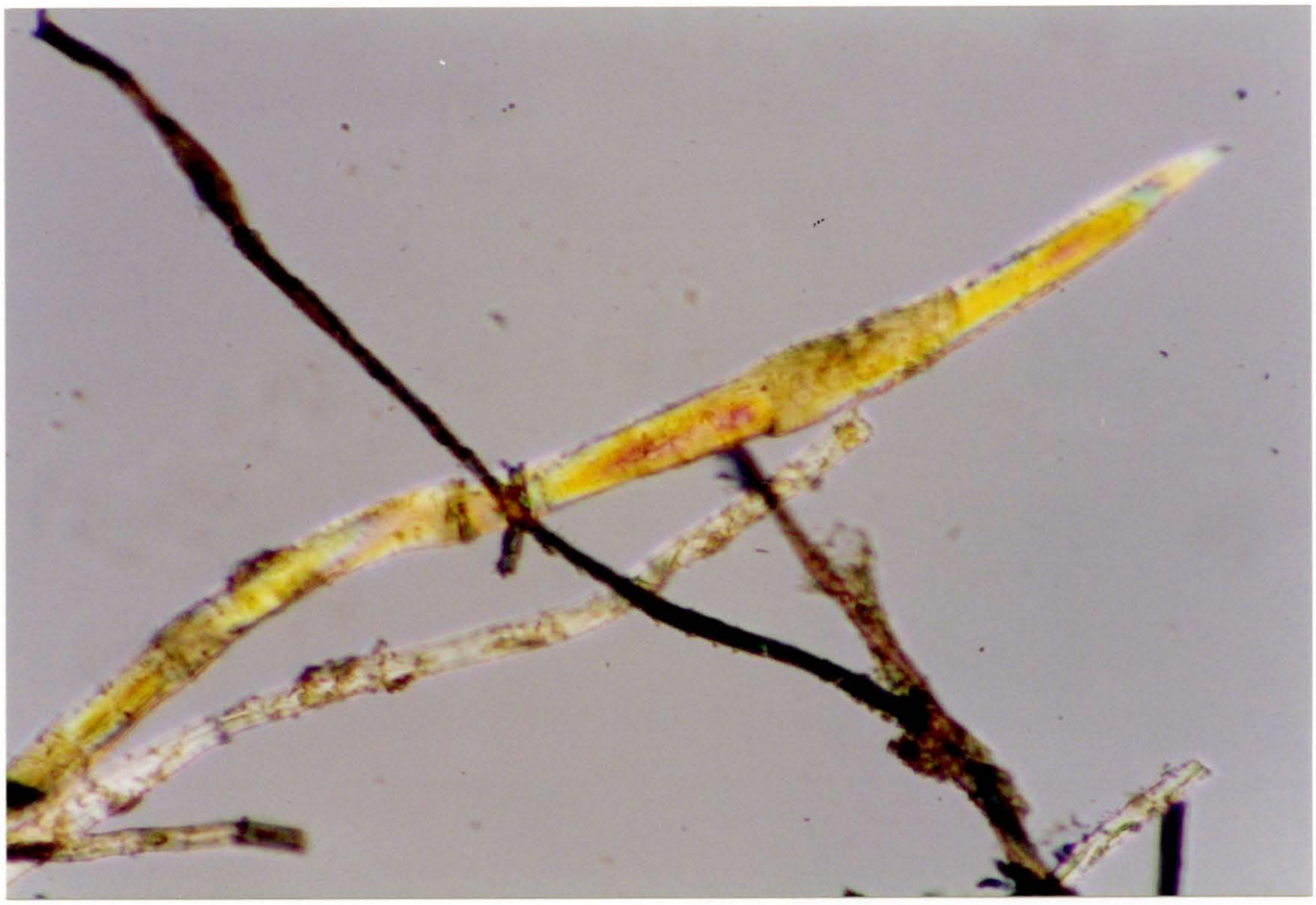
No.71 R.A.S. 13 pp.14,15,18 Thymelaeaceae 100x 28° polariser angle.



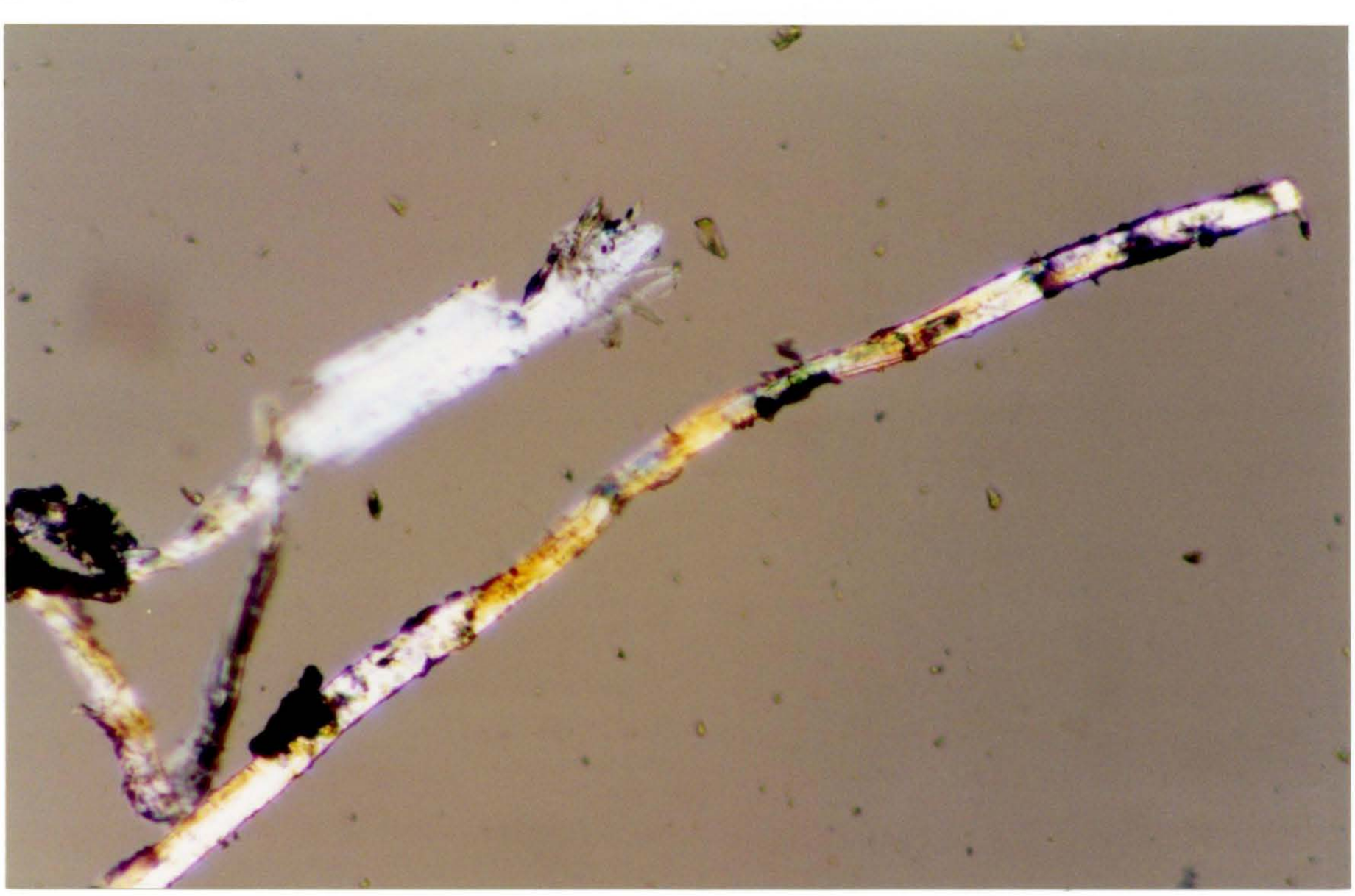
No.72 R.A.S. 13 pp.16-17 Thymelaeaceae 100x 34° polariser angle.



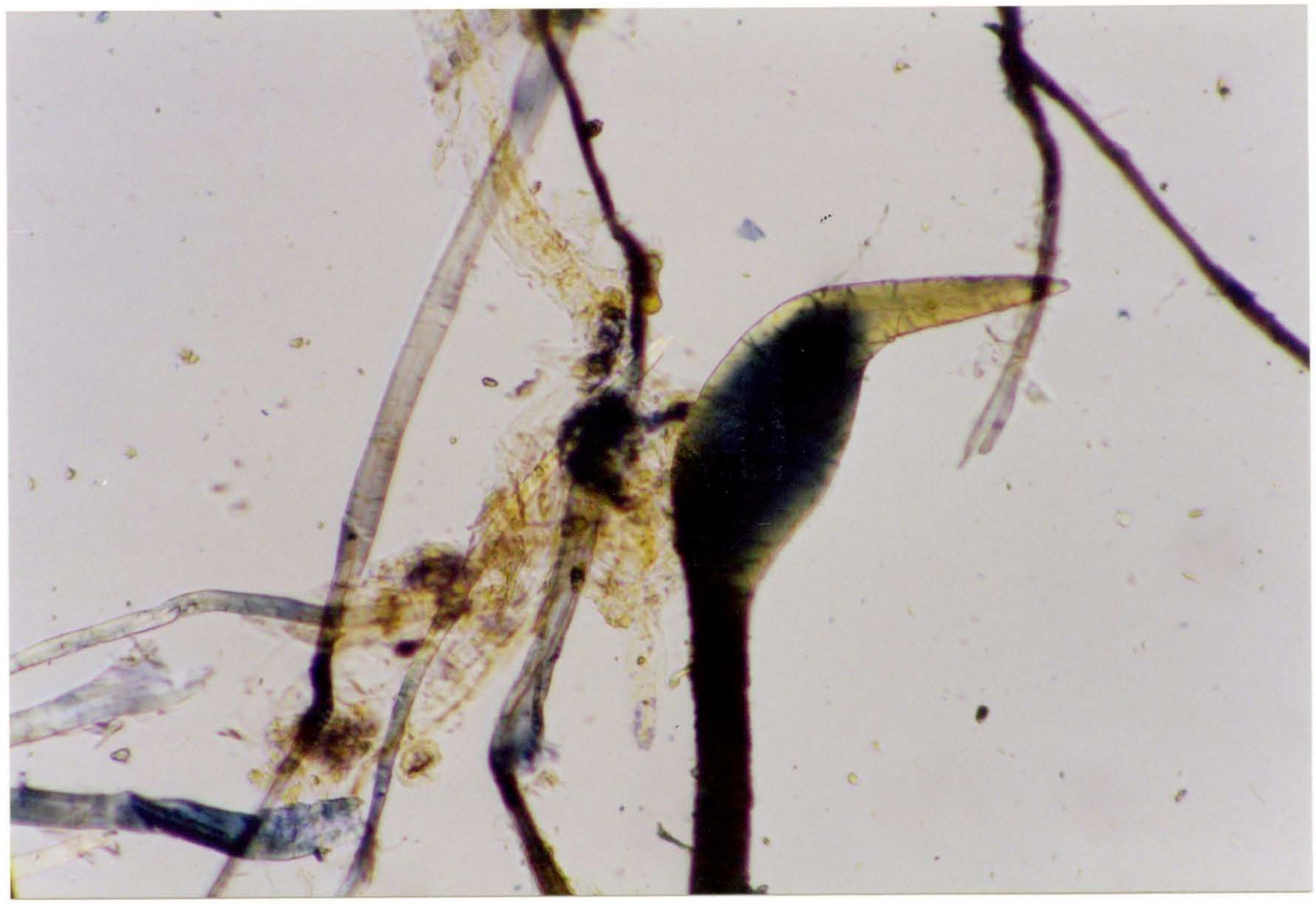
No.73 R.A.S. 13 p.19 Thymelaeaceae 100x 33° polariser angle.



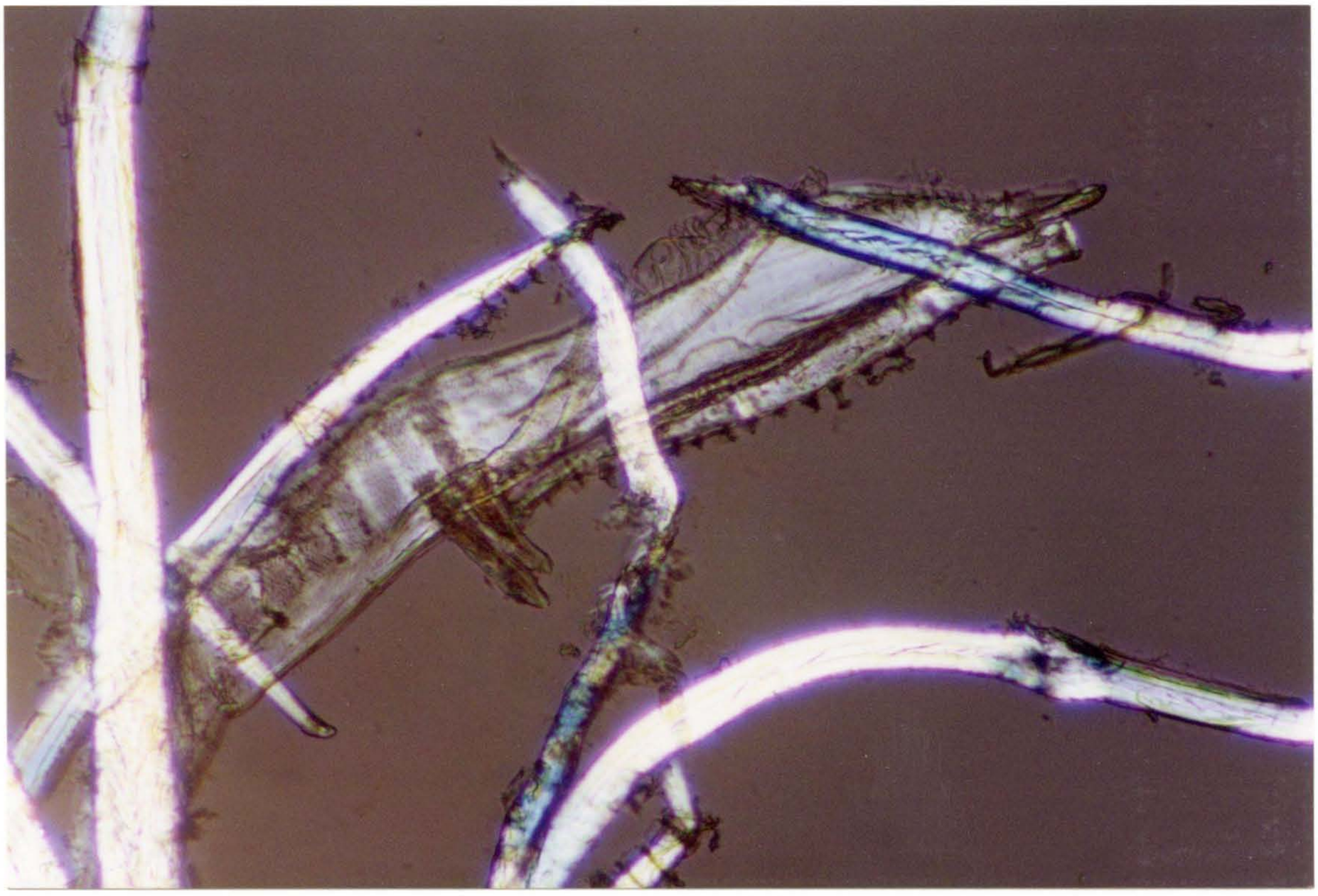
No.74 R.A.S. 13 pp.20-21 Paper mulberry & Thymelaeaceae 100x 34° polariser angle.



No.75 W.I. 11b Paper mulberry & Thymelaeaceae 100x 20° polariser angle.



No.76 W.I. 38 Thymelaeaceae 100x 42° polariser angle.



No.77 W.I. 11b Book board. Fibre unidentified. 100x 15° polariser angle.

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